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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor, J. McKeen Cattell, Garrison-on-Hudson, N. Y.

*ON THE ABSORPTION OF CONDENSATION-PRODUCING ATMOSPHERIC DUST BY SOLID NUCLEI AND SURFACES, AND ON THE DIFFUSION VELOCITY OF SUPPOSEDLY NON-IONIZED DUST PARTICLES.**

LET r be the radius of a tube stretched along the axis X, and conveying dust-laden air at a velocity, v. Consider two sections at a distance dx apart; the dust entering per second at the near face is $\pi r^2 n v$; the dust leaving per second at the rear face is $\pi r^2(n + [dn/dx]dx)v$, if the air current is kept constant and n is the density of dust distribution, or is proportional to the number of particles per cubic centim. On the other hand, the absorption of dust particles by the walls of the section in question, is $k \cdot 2\pi r \cdot n \cdot dx$, where k is the absorption per square centim. per second, per unit of dust concentration, and the absorption, as a first hypothesis, is taken proportional to the density of distribution of particles in air.† Hence $-\pi r^2(dn/dx)dx \cdot v = k \cdot 2\pi r \cdot n \cdot dx$,

$$\text{or} \qquad \frac{dn}{n} = -\frac{2k}{vr}\,dx. \qquad (1)$$

Let the density in case of air saturated

* Preliminary report of work made with a grant of the Smithsonian Institution, and published by permission of the Secretary.

† Briefly k is the diffusion velocity of the dust particle, *i. e.*, its normal velocity in air at rest. Equation (1) neglects the spontaneous dissipation of dust particles. This is permissible for the fast air currents v of Table I. The full equation is treated below.

with dust be taken as one. To determine the constant of integration it is to be observed that when $x = 0$, or $k = 0$, there is no absorption; but the current of air must nevertheless be kept up passing either through the absorption tube or not, to retain a colored field in the color tube. Now saturated dusty air would be objectionable seeing that an opaque field is produced unsuitable for measurement. Hence even when $x = 0$, or $k = 0$, the influx current is unsaturated, and we may suppose this minimum current to be obtained through a fixed initial length of tubing, x_0, of the same kind. Thus the tube virtually begins at $-x_0$, and equation (1) becomes on integration

$$n = e^{-\frac{2k(x+x_0)}{vr}}. \qquad (2)$$

If the observations be so made that the dust density issuing from the length x of tubing is constant, we have for a given color tube, $n = n'$ and

$$\frac{x + x_0}{v} = \frac{x' + x_0}{v'}. \qquad (3)$$

For different tubes under the same conditions,

$$k/k' = \frac{vr}{x + x_0} \Big/ \frac{v'r'}{x' + x_0}.$$

Hence, ignoring the undeterminable constant, one may write briefly

$$2k = vr/(x + x_0). \qquad (4)$$

With this preliminary theory as a point of departure, I have been making an extended series of observations on the condensation of supersaturated steam obtained from jets, and following the general method of color tubes described in my memoir* on the subject published by the U. S. Weather Bureau in 1895. By passing measured quantities of air (V litres per minute), saturated with the emanation of phosphorus, through different lengths of absorption tubing,* and regulating the air current by a graduated stop-cock till a definite color (full blue) appears in the field of the color tube, the condition $n =$ constant is fulfilled, on provision that no change has occurred in the action of the tube during the interval. As V is the influx of dusty air per minute, $1000v/60 = \pi r^2 \cdot v$, and as $2k = vr/(x + x_0)$,

$$k = \frac{2{\cdot}65}{r} \cdot \frac{V}{x + x_0},$$

where $V/(x + x_0)$ is given by the observations of volume in terms of length of absorption tube for a fixed blue in the field of the color tube. If V_0 be the minimum volume, *i. e.*, the influx volume of dusty air corresponding to $x = 0$, $k = 2.65/r \cdot V_0/x_0$; hence, finally,

$$k = \frac{2{\cdot}65}{r} \frac{V - V_0}{x}. \qquad (5)$$

Aside from the difficulty of observing subject to color criteria, equation (3) is well borne out by the data obtained, to the extent that V is a linear function of x. V_0, however, does not always coincide with observation, and a certain additional tube length must in certain cases be added to compensate for the dissipation (eddies?) encountered on entering the absorption tube. But this is non-essential.

A brief summary of the present results is given in the following table, which shows the material of the absorption tubes, their diameter, the variations of length (x) and volume (V) occurring in each series of experiments (usually 10 or 20 in number). The pressure under which steam issues from the jet is shown under p (centims. of mercury), and the temperature (°C.) of the air flowing into the color tube, under θ. Within reasonable limits, discussed elsewhere, the color tube is not sensitive to

* A Report on the Condensation of Atmospheric Moisture; Bulletin, No. 12, pp. 104, U. S. Weather Bureau, Washington, 1895.

* Ordinary tubing used for absorption purposes, *i. e.*, to catch the dust particles moving laterally out of the dust-laden air current.

either of these variations. The table also gives the ranges of the velocities of dust-laden air through the absorption tubes resulting from the differences of length, and the limit of values computed for k showing the errors of measurement. The final column contains the mean value of k obtained from the data as a whole.

TABLE.—ABSORPTION OF PHOSPHORIC DUST* IN TUBES.

Tube of	Diameter.	Range of Lengths, x	p	θ	Range of V†	Range of v‡	Range of k	Mean k
Gray rubber	.64cm.	0–455cm.	4cm.	26°	.7–7.0	40–360	.08–.12	.123
Pure rubber	.35 "	0–300 "	6 "	24°	.5–4.2	80–740	.12–.16	.137
Lead	.63 "	0–300 "	5 "	27°	.5–4.6	30–250	.15–.18	.162
Lead	.32 "	0–150 "	9 "	27°	.7–2.0	140–410	.....	.160
Glass	.29 "	0–150 "	8 "	27°	.8–2.0	200–480	.....	132

In view of the widely different values of the velocity with which the dust laden air traversed the absorption tubes, the high velocities employed and the marked difference of material which makes up the absorbing walls, the close proximity of the values of k is particularly noteworthy when the meaning of this constant is called to mind: k being the absorption per square centim. per second per unit density of distribution, is simply proportional to the velocity of diffusion of the phosphorus emanation, or in other words, to the velocity with which the particles ejected from phosphorus by an oxygen reaction travel normally through the surrounding air. In the cases of glass, of impure vulcanized gray rubber, of pure brown rubber, this velocity is so far as observation warrants, the same. In the case of lead tubes the velocity set forth by k is slightly larger, a circumstance which may have an electrical or a chemical bearing, or be referable to the greater density of these tubes. It is entirely premature to speculate upon it. It remains to be seen whether greater refinements of method* will rather bring the k-values to coincide for all condensing surfaces or accentuate differences.

At all events, it is already clear that the velocity of the phosphoric dust particle is independent of its density of distribution.

In the Bulletin cited, the work of which was done in 1893, and elsewhere,† I denied that colored cloudy condensation was ever due to ions, a theory then rife and particularly discussed by the younger v. Helmholtz, Bidwell and others. None of these investigators have, to my thinking, made out a clear case. Since the advent of the X-rays and of the brilliant work done at the Cavendish Laboratory, however, the status of the question has changed materially. Nevertheless I am still loth to abandon my former conviction that condensation is always primarily due to nuclei; and that whether they are ionized or not (none were certainly known until recently), is a matter of secondary and perhaps negligible consequence. Thus for instance, concentrated sulphuric acid is a dust producer comparable to phosphorus; and yet this is the very reagent that has always been used in drying the chambers of apparatus when high insulation is specially wanted. Certainly one would be rash to thrust the wily ion in such a chamber. Indeed the interest which attaches to the above results is this,

*Similar results were obtained with dust particles ejected by concentrated sulphuric acid.

† Litres per minute.

‡ Centims. per second.

* The color estimates in the table were made by the eye. It will not be difficult to repeat them relative to some fixed standard blue.

† *Nature*, XLIX., p. 363, 1894.

that strong evidence is afforded in favor of a specific velocity of the particles of a supposedly non-ionized dust, so far as the phosphorous emanation has been known. Since they are always absorbed they must clearly soon vanish out of any vessel, usually within five minutes if considered in bulk. A large part of this dissipation is referable to the grosser dust particles in ordinary air.* Thus if phosphoric dust and a suitable small quantity of smoke of ammonium chloride (made in the usual way) be passed into the color tube, the field which is opaque with phosphoric dust alone, becomes cleared when the sal-ammonium smoke is added. The larger particles of the latter have therefore captured the finer particles of the former (phosphorus emanation); and as sal-ammonium smoke alone, if not itself opaque, is unable to produce colored cloudy condensation or opacity, the field clears at once. Now if sal-ammonium smoke can capture phosphoric dust then it is conceivable that agencies may exist which reverse the fortunes of war and liberate phosphoric dust. Heat is such an agency. If nearly effete dust be passed through a hot tube (say above 400°), experiment showed me that the condensation producing tendency is again restored, precisely as if the dust were dissociable. At a higher temperature still, though not necessarily above red heat, the tube itself becomes an energetic dust producer at its inner walls, even when of glass so that experiments of the present kind are delicate. Indeed long ago I asserted that the strong dust producing activity of flames was a conversion of coarsely disseminated into finely disseminated atmospheric dust, a conversion of the planets of this microcosm into nebulæ, as it were.

One may readily conceive the X-rays to be another such agency. After some trials I devised a form of apparatus appropriate for my purposes, by which the condensational tendency of air energized by X-rays,* shows almost as powerfully in the color tube as does the older dust laden air. So far as the effect of these different kinds of dust on the color field is concerned, one would be unable to distinguish any noteworthy difference of behavior. Both may be carried through tin tubes 2 inches in diameter and over 60 feet long, taking one or more minutes in the transfer, without encountering fatal diminution in the condensation producing power of either. Other and now well known experiments of an entirely different nature go to show that X-ray dust is ionized, or transferred in a region of ionized gas, whereas the ordinary dust, with which I have chiefly worked, is not; but I ask, if both classes of dust are under proper limitations, equally able to induce condensation in supersaturated aqueous vapor, how can one single out the exceptional quality of ionization as the cause of this tendency? It has been brilliantly proved by J. J. Thomson, Rutherford, Chattock, and indirectly by C. F. R. Wilson, that ionized dust has a definite velocity; but in as far as the above experiments have weight, so has the supposedly non-ionized dust.

* This secondary dissipation is neglected in the differential equation (1), being of much smaller order than the surface effect investigated. With the wide tubes (diameter 2 inches), presently to be mentioned, the differential equation replacing (1) above is

$$-\pi r^2 v\, dn/dx = kn2\pi r + k'n^2/v$$

where k' is the number vanishing per second per unit of concentration of dust in air. The last term decreases as v, the velocity of the air current increases. This equation is easily reduced as a case of Riccati's equation, and the integration may therefore be made without difficulty.

* Of course, the X-ray tube must be boxed up most carefully, the rays shining through an aluminum window, and the terminals imbedded in paraffine. Any highly potentialized conductor, like a hot body, is apt to dust the air.

One way of escaping between the horns of the dilemma is to suppose the ionization to exist even when not directly evidenced. Thus most of the dust with which I have worked is derived by oxidation, or by heat implying chemical action or dissociation, or from highly potentialized matter, etc. Phosphoric dust is quite inactive at low temperatures and in a current of air free coal gas. The same is true of molten sulphur. Concentrated sulphuric acid, however, shows increased activity when a current of coal gas is passed through it into the color tube; but the action here is probably a destruction of the coarse dust particles in air, the effect being similar to that referred to in the case of flames. Facing the question squarely it seems extremely difficult to account for a specific velocity in the non-ionized dust particle. Being already stupefied in observing that a much larger volume of air of initially constant dust content must be discharged through a wide tube than through a narrow tube of the same material, and within certain limits of diameter, instanced by the above table, one may well be daunted in confronting the case of a specific velocity in an inert dust particle.

The need of a direct decision is, therefore, urgent; is this phosphoric dust ionized or not; or better, is it generated in an ionized region? Using an electroscope, which in the dry room in which I worked retained its charge indefinitely, I aspirated a current of air across the charged terminal without appreciable result. I then blew air which was passed over phosphorus across the terminal, and found to my surprise that even with a small current the charge was dissipated more than one-half in the first minute. It made no difference whether a positive or a negative charge was on the electroscope. Hence, phosphorus, when emitting condensation-producing dust seems also to emit some form of obscure radiation; for the dust evolution* occurs in a strongly ionized region, or the dust is itself ionized. Relative to the experiments of the above table, therefore, fresh means are at hand for computing the velocity of the phosphoric dust particle, and the electricity carried per gram, in a way similar to the famous researches made at the Cavendish Laboratory, independently of the preceding results. This suggests one method of standardizing the colors of my color tube, absolutely in terms of the number of dust particles per cubic centim. producing the color effect.

With the question thus happily answered in the case of phosphorus, I next examined air passed over concentrated sulphuric acid, but found it without effect even on the electrometer. Though the acid is a weaker dust producer than phosphorus, the present electrical result seems out of proportion to the data of the color tube. The decision made is therefore partial, but I have not advanced beyond it. Other dust producers might be instanced in the same category, and it is for this reason that I have retained the antiquated designation 'dust' in this paper.

I may add that in the experiments which I have under way, I have been dealing somewhat extensively with questions of the above nature, using dust either ionized or not. My methods, however, are all restricted to an application of the steam jet,

* I shall show elsewhere, and have since verified experimentally, that if air energized by phosphoric dust be maintained between the plates of an air condenser, the difference of potential, ϕ, vanishes according to the equation

$$\phi = \phi_0 \varepsilon^{-nket}$$

in the lapse of time t, where e is the charge per particle. For different thicknesses, d, of air, the decay of energized dust particles in successive layers of air is very similar to the absorption of light in successive thicknesses of medium, viz., $n = n_0 10^{-ad}$. In my experiments I found $a = .25$, and thus the number of particles is reduced to 1/10 in a layer of air 4 centimeters thick.

since this is an instrument with which I am familiar, and since this mode of attack has not at all been cultivated by the recent investigators on allied questions. The steam jet method has undoubtedly many grave shortcomings; but it has one invaluable advantage of retaining a given color of field for an indefinite interval of time, so long as the conditions of action are left unchanged. My present work has shown me, moreover, that the complicated character of the evidence derived from the jet, is much less serious than I have hitherto supposed. Among the inquiries with which I have been much occupied, is a determination of the number of particles which give rise to a given colored condensation in the field of the color tube, contributing to an optic phenomenon of exceptional interest, the theory of which is as yet quite unknown. Should this phenomenon yield to treatment, there would be given, since there is no serious difficulty in finding the collective mass of the particles, an independent method, and one not depending on electrical agency, of ascertaining both the individual velocity and possibly the mass of these subtle and pervasive dust particles, absolutely. For let m_0 and m be the masses of dust absorbed per square centim. per second in the first and final sections of the absorption tube. Then $n = m / m_0$ and the velocity k in equation (2) is thus the only unknown quantity.

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RECENT OUTLOOKS UPON MUSIC.

The field of music is too vast to be seen from any single standpoint. The ignoring of this simple truth has led to countless misrepresentations of facts by writers, and misunderstandings of books by readers. For tacitly it is assumed by most of us that there is only one standpoint, indefinitely thought of as that of the modern musical performer or intelligent concert-goer; and if we do recall that some mathematicians praise another point of view, while Greek, Oriental and mediæval musicians apparently had others, we yet know they have been too rarely visited to have much influence on musical thinking.

But the discoveries of the last few years bearing on the questions of the basis of music and the historical development of scales have rendered it possible for the student of comparative music to occupy a point from which many long-known facts appear entirely changed, and older authorities, as Fétis, Helmholtz and Ambros, are seen to be inadequate, if not erroneous. In comparison with this standpoint, that of the modern musician appears to be a rapidly shifting one, like an observation car or the masthead of a ship.

It is the purpose of this paper to review from this new-found standpoint some parts of four rather recent books* of more than temporary interest and value, that deal with various parts of the field; and by their aid to define the musicians' standpoint, and indicate some of the problems now before the student of the history and basis of music.

I.

Klauser's book was the first in order of publication, yet is probably the least known of the four. From title page to conclusion it bristles with novel ideas, developed during, and verified, he asserts, by many years experience in teaching. The hearty pub-

* 'The Septonate and the Centralization of the Tonal System,' by Julius Klauser. Milwaukee, 1890, pp. vi + 274; 'The Art of Music,' by C. Hubert H. Parry. New York, 1893, pp. 374; (The new English edition has the title, The Evolution of the Art of Music); 'Primitive Music,' by Richard Wallaschek. London, 1893, pp. 326–9; 'A Study of Omaha Indian Music,' by Alice C. Fletcher; with a report on the 'Structural Peculiarities of the Music,' by John Comfort Fillmore, A.M. Peabody Museum, Cambridge, Mass., 1893, pp. vi + 152.

lished commendations of such music teachers and writers as W. S. B. Matthews and C. B. Cady, of Chicago, may justify one in feeling that it is more than the work of a dreamer or idle rhapsodist,—that what he has observed of the operations of his own mind in hearing music, can be observed in other minds also.

The introduction is a vigorous plea for 'a higher education in music,' with a severe indictment of ordinary methods for their ignoring sound pedagogical principles. "The *how* is studied before the *what*:" the order should be reversed. "The musician is represented in the *what*, the instrumentalist in the *how*: the two must be combined in one individual. There is a far more important instrument than the voice, piano, organ or violin, whose technique must be developed to a high degree of automatism. This instrument is the mind" (p. 25). "The ready-made tone of the piano is a serious though not an insurmountable obstacle to the development of the mental instrument of the pianist. By the employment of logical methods, the piano is best suited as an auxiliary to a higher musical education" (p. 26). "I have already stated that the mental automatism requisite to a discriminating musician is very great. When an able musician listens to or reads a piece of music, he hears and comprehends all its melodic, rhythmic and harmonic incidents as fast as they take place in a given *tempo*. This means that he listens to music just as he would listen to any familiar tongue. * * * To stop to think is the sure sign that we do not understand" (p. 29). "I have demonstrated in my capacity as teacher that children may be intelligent musicians from the start" (p. 32). "But such results * * * are made practicable only by the simplification of the Tonal system itself. * * * The child requires a simpler foundation than the scale to begin on. The scale-half or tetrachord and the septonate supply this desideratum" (p. 33).

Then follows his novel way of looking at tones and their relations. The first chapter is mainly devoted to definitions; the tones of any series are felt to be either 'repose-tones' ('harmonics') or 'progression-tones' ('by-tones'), the latter lying a step or half-step under or over the former (p. 40). A tone is nothing definite until it is relationed in a key, that is, thought and heard in relation with a tonic, which is the point of absolute repose (p. 41). The Tonic is a CENTRAL tone or klang, and the remaining key-klangs are equally distributed *over* and *under* it (p. 42). The seven tones of the scale arranged with the tonic in the center form a *septonate*, composed of two tetrachords or *scale-halves*, an over and an under one: thus,

$$\overbrace{G—a—b}\,\smile\,\overbrace{C—d—e}\,\smile F.$$

A key-group contains these seven principals, also five up-mediates (the sharp-notes) and five down-mediates (the flat-notes), or seventeen in all, including five more sharps and five more flats; a full tone-stratum consists of twenty-seven tones; so there are only twenty-seven tonic centers, and only twenty-seven keys in music. Every key has two modes, a bright or major, and a dark or minor mode (p. 51).

In the second chapter it is suggested that "whether we will or not we cannot think a series of tones, even in one voice, except in connection with some harmony," though this is not necessarily conscious (p. 54), and then the attempt is made to prove that the accent determines whether a tone is felt to be a harmonic or a by-tone, and so accent determines harmony (p. 71).

Chapters three and four continue the analysis of tone relations and intervals; there is space only for two points: in a rising scale-half as G to C, the tones may be called Dominant, Passing By-tone, Lead-

ing-tone, and Tonic (p. 78): And second, the student should begin with counterpoint and get his earliest intelligence of harmony therefrom (p. 117); for all through attention is directed, not to harmony, but to one governing voice (p. 167).

Chapter five deals with Harmony and six with Suspensions, Inter-relations of keys and Modulation. The boldness of the author's thought about tone-relations appears in such passages as these: "It is plain that any tone and any combination may be relationed in any key. What the presiding key of the moment is, and when a change of key takes place, are matters that are determined by the melo-rhythmo-harmonic inter-relations in which a series of tones appears" (p. 221). "Modulation takes place (even in one voice) at the very moment a shift of relation to another key-center takes place" (p. 253).

The final paragraph is curious: "Since there are twenty-six keys to modulate into from any one key, and twenty-seven ways from one key into each of the others, there are $26 \times 27 = 702$ ways out of and into any one key," and "$27 \times 702 = 18{,}954$ ways in which a prominent voice can modulate" (p. 265).

So much for a meagre presentation of the author's views. While there are many quotable passages in his book, it is strikingly free from quotation, and the very few references to other writers are general, not specific. He objects to Dr. Riemann's theory that major and minor are polar opposites (p. 96), and feels that Helmholtz's explanations are inadequate (p. 270), on which points the reviewer agrees with him. As an offset to his serious discussion he gives a page on nature-music which is more fantastic than Gardner's book of sixty years ago. The student of comparative music notices with interest how this most modern exponent of music interpretation and of music psychology throws away notions of the scale that have been laboriously and fruitfully developed during the last 800 years, to take up the old Greek heptatonic system of two conjunct tetrachords, with *Mese* in the central position, though his are Lydian instead of the usual Dorian tetrachords. And one notices further that by limiting the series to seven tones which are repeated in successive tone-strata, this new system is brought into correspondence with more than one Oriental system; for except among Europeans the eighth note is not usually counted as belonging with the seven, but it starts a new series, and in one case is called by the happy name 'response.'

II.

The reader of Dr. Parry's book feels at once that he is under a master. The author has the degree of Doctor of Music from Oxford, Cambridge and Dublin; he is well-known as one of the leading English composers, and a number of years ago contributed to Grove's Dictionary of Music most of the articles relating to the theory of music: so he was admirably equipped by knowledge of the past, experience as a composer, and maturity of judgment to analyze the musical impulses and expressions of men and to put the results of such analysis into fitting words. Probably no book ever written is so well adapted as this to help the non-musical reader to some understanding and appreciation, both of what music is as an expression of the human soul, and of the artistic means employed in this expression. So far as can be done by one book it brings music back to where the Greeks placed it, to the position of a liberal art, of an instrument of culture as truly as poetry or history or painting; it makes musical training mean something quite other than an accomplishment, or the ability to perform or enjoy a performance, or acquaintance with the history of musicians and their works, or even the power to analyze a mu-

sical composition in the usual way. And all his wealth of information and inspiration is poured forth in a clear stream, in language precise and often felicitous, so that one may turn these pages with pleasure even for the style alone.

The earlier chapters throw some light on the subjects covered by the other books under review, and the extracts must be limited to passages bearing on these subjects. In the chapter on Preliminaries, it is pointed out that the intensity of men's pleasures or interest leads to expression; this to be intelligible requires common terms, that is, a design. Design is the equivalent of organization in the ordinary affairs of life. In music especially, form as well as design is necessary, but this book has only to do with design. Music is the expression of what is in man and, therefore, is not mainly imitative. "The story of music has been that of a slow building up and extension of artistic means of formulating utterances which in their raw state are direct expressions of feeling and sensibility." Everywhere are voices, shouts, etc., "but neither music nor speech begins till something definite appears in the texture of its material; some intellectual process must be brought to bear upon both to make them capable of being retained in the mind" (p. 5). "It was not till mankind had arrived at an advanced stage of intellectuality that men began to take note of the relations of notes to one another at all" (p. 6).

"The first indispensable requirement of music is a series of notes which stand in some recognizable relation to one another in respect of pitch" (p. 16). Then follows a thirty page account of the scales used in various parts of the world, which is quite satisfactory, being based mainly on the work of Ellis and Hipkins. While the author avoids the common error of assuming that these were attempts to obtain our scale, he has been misled in some cases by the dogmatism of some of his authorities, as in treating of the Persian-Arabian scale; and he has not got so far away from the modern musician's position as to observe more than what other people have done; their principles and their reasons have escaped him. His "summary is sufficient to show the marvellous variety of scales developed by different nations for purely melodic purposes" (p. 44). Of our scale he says the functions of the notes (dominant, mediant, etc.), are always being expanded and identified with fresh manipulations of the principles of design by able composers: the classification of these functions puts our harmonic scale eight centuries ahead of all melodic systems; and the last stage in this development was the assimilation of all the keys to one another by equal temperament.

In the chapter on Folk-Music, it is pointed out that orderliness and intelligibility in tunes proceed parallel with the general development of capacities in a race. It is very difficult to make out what intervals savages intend to utter. The elements of design that appear among them are repetition, perhaps at different levels, and sometimes the contrast of two short phrases. Tonality marks a considerable advance, and the impression of finality depends on this. The resources of art are not sufficient to allow a long consistent development of a single movement in melodic art; so Orientals fall back on ornament; this is "the part of anything which makes for superficial effect; * * * it generally implies either undeveloped mental powers or great excess of dexterity." In modern German folk-music the harmonic basis is simple and obvious. As art-music grows, folk-music tends to go out of use; for civilization reduces everything to a common level.

From this point on the author treats

only of European music. Harmony came in to help out the church music which was slow and free from marked rhythmic effect. The beginning of harmony is due to the fact that men's voices were of different calibre; only intervals of a fourth and fifth could well be tolerated in simultaneous singing, and so the parts were doubled at these intervals; there is no reason for thinking that this was offensive, as it would be to us. "This doubling does not imply a sense for harmony" (p. 95). Slowly there came in a recognition of the value of different consonances, of discords and of interruptions of the voices. This chapter unfortunately does not recognize the important part taken by the organ in the development of harmonic ideas; the Chinese have had slow sacred music and voices of different calibre for thousands of years, but have no harmony: the organ we believe was the instrument that brought about the development.

In the following chapters Pure Choral Music, Secular Music, Instrumental Music, The Sonata-Form,and Opera are traced from their beginning, with constant reference to the aims and methods of the great composers, and to their share either in enlarging the resources of design or giving expression to human feeling. The temptation to quote at length is very strong. One passage (somewhat condensed) from the chapter on Modern Tendencies will give an idea of the manner of treatment: Palestrina without emotion embodies the most perfect presentation of contemplative religious devotion. Bach * * * formulates a more liberal and energetic type of religious sentiment, and foreshadows by his new combination of rhythm and polyphony the musical expression of every sort of human feeling. Beethoven expresses the complete emancipation of human emotion and mind, and attempts to give expression to every kind of inner sensibility which is capable and worthy of being brought into the circuit of an artistic scheme of design. * * * The love of art for art's sake is at best a love of beauty for itself. * * * This is inevitable at one stage; but humanity as it grows older instinctively feels that the adoration of mere beauty is sometimes childish and sometimes thoroughly unwholesome; and men want to be sure that the human energies are not sapped by art instead of being fostered by it. After both beauty and expression have reached a high plane men seek for strong characterization, as in all the arts to-day, and especially in literature.

Finally, one more quotation somewhat condensed may be commended to the careful study of all who attempt to interpret the music of strange peoples in terms of European music. "Wagner's harmony is the result of polyphony in great measure; he does not abandon tonality, but uses it with quite remarkable skill and perception of its functions; in accompaniment of the ordinary dialogue he is often very obscure in tonality, just as J. S. Bach is in recitative. For straightforward ideas he uses simple diatonic figures; for something specially mysterious, chords which belong to two or more unassimilable tonalities on purpose to create the sense of bewilderment, and a kind of dizziness and helplessness which exactly meets the requirements of the case. If people's sense of tonality were not by this time so highly developed such passages would be merely hideous gibberish, and they often seem so at first" (p. 356).

III.

Wallaschek's book on 'Primitive Music' takes us from the most extreme modern position to the consideration of the beginnings and rude early manifestations of the musical art. The first fifth of it is devoted to a collection of explorer's reports on savage music, little reference being made to peoples who have developed a musical

theory, as the Arabs and Hindus. The materials for this chapter have been collected from a wide field, and the reviewer can bear witness to the thoroughness of the search, as he had previously gone over a large part of the ground.

In the following nine chapters much of this matter, with some additions, is arranged under these heads: Singers and Composers; Instruments; the Basis of our Musical System; Physical and Psychical Influence of Music; Text and Music; Dance and Music; Primitive Drama and Pantomime; The Origin of Music; Heredity and Development. Then follows a full Bibliography, an Index and 25 melodies. The author's standpoint is that of a psychologist, as is evident from his papers in *Mind* and in German journals; so he seems most at home in the later chapters.

It is unfortunately true that few of the travellers whose reports are quoted showed any particular fitness to speak on musical questions, or especially to write down correctly as to rhythm and melody the songs they may have heard; so the reports must be used by the student with great care and discrimination. The author's uncritical treatment of his material may be judged from this passage: "In Virginia (North America) for instance, several rattles are tuned together, and the natives have 'bass tenor, counter-tenor, alto and soprano rattles'" (p. 103). On looking for the authority for this statement, made as if true for to-day, one finds it at the end of the book John Smith's History of Virginia; but the date of publication (1624) is nowhere given. Another passage will throw light on the author's judgment of what facts are important and characteristic: After referring to musical contests for endurance among savages he says: "Barbarian as it may appear to be such performances are still in use in America, the modern counterpart being the 'musical' contest which took place at Huber's Museum, New York, on the twenty-third of October, 1892"; the lady played the piano 16 hours 52 min., her competitor, a man, 17 hours; she received five proposals of marriage (p. 72)! Must we confess that America is not entitled to the barbaric preëminence tendered her, for the *London Musical Times* tells of a man who played the piano in public for twenty-five hours consecutively, again for thirty-six hours, and again for forty hours.

In connection with the present review, Chapter IV. is of most interest, for in it are presented the similarities between savage music and ours; the matter is arranged under the three heads of: (1) Harmony, (2) Major and Minor Key, (3) The Scale. Much is made of the facts that various reporters tell of savages singing in two or several parts; the Hottentots especially are said to have keen ears, to be able to give excellent imitations of German hymns after once hearing them, and to employ harmony. The author concludes, "thus neither harmony nor the germs of counterpoint are entirely unknown to primitive nations, and it would seem from all the examples that I was able to collect that the principle of tonality is in most cases unmistakable" (p. 142). It cannot too positively be declared that such a statement is misleading, and in the sense that most readers will understand it, is utterly false; the musical dictionaries give six meanings for the word 'harmony'; it is only by using the word in a very loose and unusual way that it can be applied to the simultaneous singing of any savages yet reported; the use of the terms counter-point and tonality is equally loose.

In the next part comes the statement "it is surprising how often savages sing in the minor key" (p. 145); then various instances are noted of minor music though the ideas are merry and vivacious. "This occurrence of minor chords in savage music is no

doubt of the greatest importance and will have to be taken into consideration in further researches on the physiology and psychology of music. * * * It is questionable whether savages notice any peculiar difference." As historically our minor came late into use, "we may connect with it the idea of the unusual, and may use it on occasions when something extraordinary is intended" (p. 149)! There is no need of quoting more, for the author knocks the foundation out from under his philosophical structure when he says, "it is also the uncertainty of intonation and the constant fluctuation of the voice which give us the impression of the minor key rather than of the major." One might as well say that the uncertainty of articulation of a savage speaking in his own tongue gives the impression of say cockney English, rather than English as spoken in Boston. Later we shall return to this matter of the interpretation of the sounds one hears.

The last part of Chapter IV., on the scale, is chiefly notable for the author's repeated assertion that the diatonic scale has been the constant basis in the development of music; for his clear-cut statement that the scale cannot be founded entirely on any natural properties of the ear or laws of the constitution of musical sound; and for his insistence on the instrumental origin of scales. The first of these three points is demonstrably inadequate and untrue; the others we believe to be true and important, though often ignored or denied.

In view of the great dearth of books covering this field it is but slight praise to call this decidedly the best one in the market. Some of its defects have already been pointed out; the author is from the nature of the case compelled to build with such materials as other men bring him; some are of excellent quality, some are rubbish; there is, therefore, unusual need for a careful critical treatment of them. But all students of the subject will welcome his collection of material, and the bibliography and many suggestive passages, though they will hardly be willing to cite his conclusions as authoritative.

IV.

Miss Fletcher's monograph is by far the fullest and most carefully-made collection of savage music of which we have any knowledge. Her discriminating remarks on the difficulties of observing and recording what was sung may be commended to those who, like the author of the preceding book, seem to think any statement of a traveller is good evidence, or that it is an easy matter to note down characteristic music. This collection is the fruit of ten years of study, including many years of life among the Omahas: it is therefore written from an intimate knowledge of the life of the people; throughout it impresses the reader with the feeling that it is a remarkably sympathetic work; that never did an author enter more fully into the thoughts and feelings of an alien race. For this is far more than a collection of carefully noted tunes, difficult and admirable as such a work would be; there are added the meaning of the song to the people who use it, and the circumstances in which it is used, so that the reader may appreciate it somewhat as the native does.

The melodies thus collected were put into the hands of the late Professor Fillmore for study. He sums up the results of a laborious and interesting investigation thus: "The deficiencies and defects of Indian music are, first, lack of sensuous beauty of tone-quality; second, uncertainty of intonation. * * * The merits of the Indian music consist, first, in an elaborate, well-developed rhythm; second, in fresh, original, clear, characteristic expression of the whole range of emotional experience of a primitive people. * * * The problems

presented in the study of primitive music are two: 1. The problem of the origin and function of music; 2. The problem of the psychological, physical and acoustic laws in accordance with which the musical phenomena have become what they are" (p. 74).

The most novel part of Professor Fillmore's work is that dealing with the question of harmony in savage music. It has long been customary to add a harmony to simple melodies of people who never use accompaniments; and as many as thirty years ago Carl Engel showed the great danger of distorting the meaning of a tune by this procedure. But the author takes an almost opposite position, and maintains it with vigor; he holds in substance that the meaning of these songs cannot truthfully be presented without harmonizing them; certainly their interest is greatly increased, as no one can doubt who has had the privilege of hearing them rendered by the authors of this book and their coadjutor Mr. La Flesche; so rendered, some of them are very fine and inspiring and moving. In adding the harmony Professor Fillmore has taken the unusual precaution of submitting every piece of music to native judgment, and out of several modes of harmonization has selected that one which pleased Indian hearers best. As a result of this long testing, he concludes that the matter of scales to which ordinarily so much attention is given, is entirely subordinate; that any peculiar scale can easily be accounted for on harmonic grounds; and that the tonality is to be decided "not alone from the tones actually employed in the song, but from considering what tone or tones need to be supplied in order to make a natural or satisfactory harmony" (p. 64). Above all he thinks he has proved the existence of a 'latent harmonic sense' unconsciously determining the choice of melody-tones, or as stated in another place, "It seems clear to me that the course of these melodies can be accounted for in no other way than on the assumption that the Indian possesses the same sense of a tonic chord and its attendant related harmonies that we do: although of course it is latent and never comes clearly forward into his consciousness" (p. 76). But in spite of this positiveness of conviction there is a suggestive doubt expressed in the last paragraph; "how the feeling for the tonic chord is generated in melodies which do not begin with the key-note, and especially in those which begin with a by-tone, as some of these songs do, I am as yet unable to conjecture" (p. 77).

These views of the joint authors have received hearty (though not universal) acceptance in musical circles, but ethnologists and other students of the problem of savage music dissent from them. To make clear the fundamental reason of this dissent, it will be necessary to go back and recall some things that the other books under review help to establish. To do this is important; for it is the reviewer's firm conviction that no one thing so hinders the intelligent study of non-European music as the wide prevalence of views similar to, though less clear and well developed, than those of which Mr. Fillmore is so able a defender.

And first it is to be recognized that all these authors have much in common, and, however divergent their outlooks, occupy substantially the standpoint of the modern European musician: so, collectively, they help to make more evident than a single book does just what this standpoint is. Klauser declares and Parry implies, as quotations from both have shown, that music is not a physical, but a psychological product, that most of its meaning anywhere is due to habituation, to long familiarity with the elements out of which it is built up; that it is conventional, in the same

sense that spoken language is conventional. The listening musician is constantly trying to find the composer's meaning in a passage always imperfectly rendered; so he is being constantly trained to correct instinctively the sounds heard so as to fit them into his scale; then more or less consciously he notes the inter-relations of the sounds, the key and mode, modulations, rhythm, etc., for if these elementary things are obscure, the musical thought must be still more so; the case is closely parallel with the understanding of a spoken discourse. All this training and more is implied in the term 'musician.' Klauser's purpose is to promote such training and make the student conscious of it: Parry throughout implies that it is the basis of musical intelligence, and sometimes recognizes it rather explicitly: Wallaschek shows something of it: Fillmore and Miss Fletcher are saturated with it.

Now when a musician thus trained hears foreign music he cannot ordinarily help treating it in the familiar way, and assuming both that his notation is suitable, and that his familiar ideas are applicable. He reads into it his own notions and disregards what seems foreign to his established system. The students of savage and oriental languages have passed through and beyond this stage of development; so to-day the laity as well as scholars know that the utmost facility in and appreciation of one's mother tongue confer no ability to spell the words or understand the meaning of a foreign language; why then should a high musical training be thought *per se* to confer the ability to understand the music of a foreign race? We constantly hear that 'music is a universal language,' but the usual criticisms on foreign music or expressions of disgust with it show that the saying is substantially false, and that the words of a learned Chinaman to Amiot a century ago are far truer: "The airs," he said, "of our music go from the ear to the heart, and from the heart to the soul; we know them, we understand them; those that you play for us have not this effect." Fortunately a few writers have at least recognized that such terms as major and minor, modulation, tonality and harmony have very rarely, if ever, any applicability to foreign music; for instance, Mr. Parry does so in a passage in Grove's Dictionary, holding that these terms do not apply to anything inherent in this non-harmonic music, but only to the effects produced by it on hearers with European training.

It is just here, over the interpretation of the sounds heard, or the choice of a standpoint from which non-European music shall be judged, that the conflict is sharpest and most irreconcilable between professed musicians and the few scientific students of comparative music. Of the writers under review Parry has little and Klauser has nothing to indicate that there is a conflict, but they define admirably the advanced musician's standpoint; the others dealing exclusively with non-harmonic music should recognize the conflict and justify their choice of a standpoint if they would be accepted as authorities. But neither Wallaschek nor those from whom he quotes have, except rarely, made even the slightest attempt to find any other standpoint; while Fillmore repeatedly, triumphantly, and with italics declares that there is no other, saying for instance, "These melodic aberrations to which I have referred are easily and naturally accounted for by reference to their natural harmonic relations, *and in no other way*" (p. 61). His able paper is practically a challenge to every scientific student of musical problems; one must accept it and fight to victory in his own mind, or give up the contest for the application of scientific methods of research; for in effect it denies that the methods which have revolutionized the study of the history of

religion, society, language and art, can be applied to music. Moreover, if Mr. Fillmore's presentation is correct it is hard to avoid the conclusion that the Omahas, though unconscious of it, are at the same stage of musical culture as he was; for he was just able to account for every peculiarity of their music, but only by bringing in "pretty much the whole ground of modern harmonic structure," including "the use of the third and sixth relationships in harmony, one of the most notable peculiarities of the Modern Romantic school" (p. 62). One cannot resist the suspicion that the writer has portrayed a cloud-land, not real hills lying as distant from his point of view as savagery is from civilization,—a suspicion strengthened by a multitude of facts, that there is no space here even to hint at.

But lest this criticism be misunderstood let us remind ourselves that in reporting music, as in writing history or producing a picture, there are two distinct ways of working; one aims either at a photographic, literal, scientific, analytical presentation, or at an artistic one; rarely at both. If the worker's aim be not regarded his most successful portraiture may be considered false; the artist disregards details, aiming rather at the impression of the whole; the scientific worker must first have the details. Miss Fletcher presented her "collection of Omaha Indian songs feeling confident that therein is truthfully set forth in a manner intelligible to members of my own race the Indian's mode of expressing emotion in musical forms" (p. 7): so her aim was artistic; she deliberately disregarded the material she had collected along the lines of physical or scientific presentation. She does not pretend to give the Indian music accurately as to pitch or quality, but in a translation, as it were, or perhaps rather a paraphrase. Many persons can deny that she gives Indian music; probably she is the most competent witness on the question whether her melodies with Mr. Fillmore's harmonies express to white musicians the emotions of the Omahas. No one doubts that for Miss Fletcher's purpose the modern musician's standpoint is the necessary one: is there any more doubt that for Mr. Fillmore's philosophical and scientific purpose it is absolutely unfit, and that views from it are obscure and misleading?

V.

While all such faithful, sympathetic attempts to paraphrase foreign music are cordially welcomed, we must not forget that an even harder work remains to be done:—to find out the elements of every strange musical language, and the rules by which they have been combined, and so to come to some real understanding of the thoughts and moods that lie back of the musical expression. In spite of the brilliant successes of the present generation in making vivid before us the life and thoughts of past generations, the story of the world's music has not yet been told; and the thousands of unsatisfying pages that attempt to do it still leave the subject in the condition of Egyptian history before the hieroglyphs were deciphered. The strong light thrown by the books under review on the position of modern European musicians shows that they are even farther removed from musicians of all other lands and times, than any one realized a few years ago. So before an author can write an adequate universal history of music, he must find, and occupy at least for a time, some other standpoint than that occupied by the writers of these books.

CHARLES K. WEAD.

THE EFFECT OF THE MEXICAN EARTHQUAKE OF JANUARY 19, AT MOUNT HAMILTON, CALIFORNIA.

THE detection of the occurrence of a distant earthquake shock, by means of a Meridian Circle, appears to be sufficiently

novel to be worthy of record. The effect was noticed here, upon setting the telescope for the Nadir observation, on the night of Friday, January 19th, the date of the earthquake, most seriously felt at Colima, Mexico.

The reflected images of the threads were at once seen to be swinging across the field of vision, with a regular oscillation, much like the swing of a pendulum. The period was about seven seconds for the full amplitude of the swing. The extent of the arc could be exactly estimated, in the east and west direction, by the fixed transit threads, and appeared to be of the same amount in the north and south direction. The reflection from the surface of mercury doubles the actual angle of inclination, which was very closely 15″, for the full arc of vibration, at the maximum seen.

This corresponds to a total displacement of the eye end of the telescope of $\frac{1}{200}$ of an inch. A movement of twice this amount in the surface of the earth, when produced suddenly, will ordinarily be detected as a slight earthquake shock, and will be recorded by delicate seismographs. It would fall at II. of the Rossi-Forel scale, and is about as slight a vibration as can usually be detected. The delicacy of this test is shown by the fact of the oscillations being still easily perceptible when they had fallen to less than one-tenth of the above maximum.

It is probable that vibrations in the earth's crust of much larger extent would still be entirely imperceptible to the senses when taking place as slowly as in the present case. They are believed to extend to great distances from the active center of the disturbance, at least in special cases; and may perhaps precede the sensible shock by a considerable interval. In the additional instance, recorded below, there is little doubt that the early vibration was the forerunner of an earthquake shock, which was local only, as far as known.

In the present case, if the same vibrations extended to the summit of our large dome, they would amount to but the twentieth of an inch in actual displacement; and being of so slow a period, no injury would be anticipated. We have records here of displacements of the earth's crust during earthquake shocks of twenty times that of January 19th, coming as sharp and continued vibrations.

The oscillations were first noted at 10h. 50m. Pacific standard time, eight hours slow of Greenwich. Local time would be six minutes less. They continued of the same amplitude, apparently, for five minutes at least, and at 11h. 5m. had diminished to about one-quarter of the maximum. At 11h. 15m. they were still easily perceptible, but appeared no longer as uniform; the reflected image would appear stationary for several seconds and then continue the swing.

At 11h. 30m. the vibration had so nearly ceased that the Nadir observation was made, in order to determine whether any change had taken place in the position of the instrument. The comparisons with preceding and following determinations indicate no change in any particular. The swing was nearly as regular as a pendulum at the beginning, and there was little variation in successive swings, except as they diminished in intensity, just as a pendulum comes to rest.

The night was at that time nearly calm; the wind, which had been earlier light from the northwest, having died out. It should be added that the Nadir observation is usually easily made here. There are no shocks to be anticipated of any character at night, and the wind, even at 40 miles an hour, does not interrupt the reflection of the images. When coming in strong gusts there is no vibration at the surface, either coming from direct pressure or carried down by the walls of the building. The

last will often quiver and rebound from the impact of the wind, as if it had been hurled against us in solid form. There is, of course, some difficulty in obtaining a steady illuminating flame during high winds, but no disturbance of the mercury surface.

The last previous observation of a star had been made upon a circumpolar at upper culmination, and nothing unusual was noticed up to the time of leaving the telescope. The last thread was taken nine minutes before the oscillation was detected at the Nadir, or at 10h. 41m. P. S. T. In the interval the circles and micrometer were read and the meteorological record taken for refraction. The barometer was again read, shortly following the cessation of the disturbance, and no change had taken place. The automatic recording instrument does not indicate any disturbance in the pressure during this interval.

The probable error of a telescope bisection is not greater than the hundredth part of the oscillation, at the maximum; so that it is clear that nothing of that nature was occurring at the time of observation. Nor could it fail to be detected in the transit record.

The circular reading, itself, might not indicate the beginning of the vibration; since it was of so slow and regular a character, that the telescope would probably have not been disturbed, in its position upon the pivots. An earthquake shock usually changes the position of the telescope in the wyes; in one case a change of 3″ was noted, as effect of a small, but perceptible tremor.

There is, thus, no way in which to fix the commencement of the oscillation, between the limits of 10 h. 41 m. and 10 h. 50 m. The duration is extraordinary, especially considering its minute amount. It was continuously observed for forty minutes. So impressive and startling was its character, when noted in an instrument of such stable form of mounting, that the observer had no hesitation in announcing the coming of an earthquake for this locality. Some previous experience served as the basis for such a prediction. On May 7, 1894, a similar oscillation, but far less pronounced in extent and duration, was detected by the same means. It was followed, after an interval of an hour and five minutes, by a slight earthquake, noted by three observers on Mt. Hamilton.*

In observing from two to three hundred nadirs a year, these two instances are the only ones noted of any vibration in the mountain. The indications were that this presaged a shock of a serious nature; and the chagrin, for an unfulfilled prophecy, is easily more than counterbalanced by the relief from the experience of a severe earthquake.

The connection with the Mexican earthquake is pretty clear, taking into account the slightly detailed accounts that have yet reached us. That was most severe at Colima, and Guadalajara, six or seven persons having been killed, many injured, and much damage to old and substantial buildings having been done. The first accounts of that disaster reached us on Monday, through the daily papers; and it appears that no further details are likely to be printed in that form. At Colima, the time was given at a quarter before twelve. At Guadalajara it was recorded at midnight. These cities are 18°, or a little more than an hour east of Mt. Hamilton: so that the first statement of the time would make the epoch near the beginning of the vibration noted here. Until more exact details of the times, recorded in Mexico, are known here, it will not be possible to check for closer agreement.

The cities where the worst of the shock

* Pub. Astr. Soc. Pac., 1894, Vol. VI., p. 184. Catalogue of Earthquakes, E. S. Holden: Smithsonian Miscell. Collec., No. 1087, p. 227.

was felt, are distant 1500 miles from this point. The shock would appear to have reached IX. of the R. F. scale, at the center. It will be interesting to learn how far this side the center, any sensations were noticed. The delicate indications of a fine telescope, poised over the mercury, will fill in the gap between the borders of the sensible shock, and the far extent of the real disturbance of the earth's crust.

R. H. Tucker.

Lick Observatory, University of California,
Jan. 24, 1900.

Note.—The thirty-six-inch and twelve-inch refractors and the Crossley reflector were in use while the oscillations of the earth, recorded by Professor Tucker, were taking place, but no unusual disturbances of these instruments were noticed. The observers were not, however, aware of the disturbance of the mercury under the meridian circle.

J. E. K.

THE CHICAGO SECTION OF THE AMERICAN MATHEMATICAL SOCIETY.

The Section held its sixth semi-annual meeting at the University of Chicago on Thursday and Friday, December 28 and 29, 1899. Four sessions, two on each day, were fully occupied with the presentation and discussion of papers. Professor Moore, Vice-President of the Society, occupied the chair during the first session, after which Professor E. W. Davis presided.

The following papers were read:

(1) Mr. R. E. Moritz, University of Nebraska: 'A generalization of the process of differentiation.'

(2) Professor E. D. Roe, Elmira, N. Y.: 'On the transcendental form of the resultant.'

(3) Dr. E. J. Wilczynski, University of California: 'An application of Lie's theory to hydrodynamics.'

(4) Dr. F. R. Moulton, University of Chicago: (1) On the question of the stability of certain particular solutions of the problem of four bodies; (2) Particular solutions of the problem of n bodies of the Lagrangian type.

(5) Professor L. E. Dickson, University of Texas: 'The canonical form of linear homogeneous substitutions in a general Galois field; (2) The cyclic sub-group of the simple group of linear fractional substitutions of determinant unity in two non-homogeneous variables with coefficients in an arbitrary Galois field.

(6) Dr. J. V. Westfall, University of Iowa: 'On a category of transformation groups in space of four dimensions.'

(7) Professor O. Bolza, University of Chicago: 'The elliptic sigma-functions considered as a special case of the hyperelliptic sigma-functions.

(8) Professor Alexander Pell, University of South Dakota: Calculation of the integral

$$\int e^{-\left(px^2+\frac{q}{x^2}\right)} \begin{matrix}\sin\\ \cos\end{matrix} \left\{ rx^2+\frac{s}{x^2} \right\} dx.$$

(6) Professor John A. Miller, Indiana University: 'Concerning certain elliptic modular functions of square rank.'

(10) Professor Robert J. Aley, Indiana University: 'A new collinear set of three points connected with the triangle.'

(11) Professor H. Maschke, University of Chicago: 'Note on the unilateral surface of Moebius.'

(12) Professor C. A. Waldo, Purdue University: 'On a family of warped surfaces connected by a simple functional relation.'

(13) Professor Henry S. White, Northwestern University: 'Plane cubics and irrational covariant cubics.'

After the papers listed above had been read there followed a general discussion on the topic 'Limits of function of one or more variables' introduced by Professor Moore.

The program committee for the following year was elected at this meeting and will consist of the Secretary *ex-officio*, Professor H. B. Newson, University of Kansas, and Professor C. A. Waldo, Purdue University.

The next meeting of the Section will be held on Saturday, April 14, 1900, at Northwestern University, Evanston.

Thomas F. Holgate,
Secretary of the Section.

Evanston, Illinois.
Jan. 6, 1900.

*CORDILLERAN SECTION OF THE GEOLOGICAL SOCIETY OF AMERICA.**

A YEAR ago, as has been already reported in SCIENCE, about a dozen west coast geologists met at Berkeley and organized the Cordilleran Geological Club. The organization was at once recognized as temporary, and the project of organizing permanently as a Section of the Geological Society of America formed a leading topic of discussion at the meeting. The following spring a number of fellows of the Society resident in California memorialized the Council of the Society, setting forth their inability to be present at the meeting of the Society owing to the great distance at which they reside from the usual places of meeting, and praying for legislation on the part of the Society which would enable them to meet as a geographically distinct Section of the Society. The Section was formally recognized by the Society at its Washington meeting, and the Council of the Society was authorized to frame rules governing the Section in its relations to the main Society.

The meeting of the Cordilleran Section was very successful, and it is clear that its organization will greatly strengthen the Society in the West. Provisionally Professor Joseph Le Conte was elected Chairman, Andrew C. Lawson, Secretary, and Professor J. E. Talmage, Councilor, the three to constitute an executive committee.

The following papers were presented :

The discovery of a goat antelope in the cave fauna of Pike's Peak region. By F. W. CRAGIN, Colorado Springs, Colo.

In having the cave-earth removed from a cave in the Manitou limestone of his Glen Eyrie estate a few years since, General W. J. Palmer saved organic remains, consisting of a number of bones, and submitted them to the writer for determination. Two of the specimens belonged to a slender-limbed horse of the late Pliocene or Quaternary age. Other remains belong to a species of woodchuck, probably different from any now living in North America. A humerus and cannion bone of a two-toed ungulate were found to differ from the corresponding bones of all the artiodactyles now living in North America, but agreed closely with those of the Capricorn or Goat-Antelope (*Nemorhædus*) of the Himalayan region. In recognition of General Palmer's liberal patronage of science the species is named *N. palmeri.*

The finding of goat antelopes in the extinct fauna of the Rocky Mountains, though unexpected, is no more remarkable than the occurrence of elephants, which are also of Oriental origin.

On the occurrence of ground-sloths in the Quaternary of Middle California. By JOHN C. MERRIAM, Berkeley.

The remains of two ground-sloths have recently been obtained from Middle Californian deposits of unquestioned Quaternary age. The first specimens found consisted of large humerus fragments obtained by Judge Jomes, of Martinez, Calif., on the south shore of Sŭisun Bay. Associated with them were remains of *Elephas* and a large species of *Equus.* During the past year, 1899, Mr. A. Huff obtained a large and perfectly preserved humerus from loose, horizontally stratified deposits on the eastern shore of Tomales Bay, in Marin County, Calif. An *Elephas* tooth seems to have been obtained from the same deposit.

The specimens from the two localities seem to belong to the same or closely related species. This form fits most satisfactorily into Marsh's genus *Morotherium*, which was described from material obtained in Alameda County, Calif.

Classification of the John Day beds. By JOHN C. MERRIAM, Berkeley.

The John Day beds average about fif-

* First annual meeting, San Francisco, Calif., December 29 and 30, 1899.

teen hundred feet in thickness, and apparently contain a very large proportion of volcanic materials. They seem to rest unconformably on a thick series of plant bearing, fresh water beds, which have been considered Eocene. The Columbian lavas rest apparently unconformably upon the John Day beds.

On the basis of lithologic and stratigraphic characters, the John Day System may be divided into three divisions, lower, middle, and upper John Day. The lower beds are mainly colored a brilliant red, seem to have suffered more disturbance than the higher beds and are practically barren of fossils. The middle beds are blue, green or drab, and are in in places quite fossiliferous. The upper beds are bluff or white. They are largely made up of volcanic material. Many fossils have been obtained from this division. One horizon particularly is rich in rodent remains.

The writer's study of the vertical range of the John Day species has not progressed far enough to permit of any definite statement regarding their zonal arrangement. Professor J. L. Wortman has already proposed the division of the system, on faŭnal grounds, into upper *Merycochaerŭs* and lower *Diceratheriŭm* beds. The use of the lithologic divisions here proposed will greatly aid in the study of the vertical range or history of John Day species.

Notes concerning erosion forms and exposures in the deserts of South Central Utah. By J. E. Talmage, Salt Lake City, Utah.

A description of the effects of denudation in the region lying east and south of the Thousand Lake Mountain, and west of the water pocket fold. The dissection of the Trias and Jura was illustrated by numerous photographs. In the work of rock disintegration much importance was attached to the great diurnal range of temperature, the range being 80° to 85° F. during the autumn months. Dykes and hills are prominently exposed in certain parts of the region. Selenite geodes similar to that first reported in Science, February 17, 1893, are of frequent occurrence.

On certain peculiar markings on sandstones from the vicinity of Elen Cañon, Arizona. By J. E. Talmage, Salt Lake City, Utah.

The paper was illustrated by photographs and slabs of the rock. The markings appear as right lines with approximately rectangular intersections; the lines are shallow troughs from .5 mm. to 2 mm. in width though occasionally in coarser rocks they are as much as 9 mm. wide and 3 mm. deep. The rectangles have an average size of about 4x6 mm. Unbroken lines of 395 cm. have been traced. The rock is a fine-formed argillaceous sandstone of brick red to chocolate color. It occurs as a bed two feet thick between coarser sandstones. Ripple marks, rain drop impressions and sun cracks appear in the marked rock.

Attempts to reproduce the right line markings were described, leading to the conclusion that the lines are perhaps the result of crystalline cleavages in saline cakes deposited through desiccation. Pinate impressions suggesting frost flower pictures occur with the right line markings and these were reproduced experimentally. Slabs of the stone $2\frac{1}{2}$ square yards in size and completely covered with the right lines were taken from the deposit.

Conglomerate 'puddings' from the Paria River, Utah. By J. E. Talmage, Salt Lake City, Utah.

The paper was an explanation of photographs, showing a number of fresh conglomerate masses, consisting of pebbles and mud formed by accretion through rolling. The formation of these puddings was observed on the mud flats of the Paria. The sticky mud and river, worn pebbles readily cohere, and by rolling the lumps, increase in size

and were found ranging in size from three inches to two feet in diameter. When left to dry they fall to pieces. Some were observed partly buried in the mud; and it is probable that many have been covered up by flood deposits.

Thomsonite and other zeolites from Golden, Colorado. By HORACE B. PATTON, Golden, Colo.

The points of interest are remarkably beautiful and delicate masses of Thomsonite recently found, and the extraordinary variety in habit of this material in the same and closely adjacent cavities. The paper was accompanied by photographs.

The peneplain question upon the Pacific Coast. By H. W. FAIRBANKS, Berkeley, Calif.

A topographic study of the islands of Southern California. By W. S. TANGIER SMITH, Berkeley, Calif. Presented by Andrew C. Lawson.

The islands are classified according to their general physiographic features, and the main reasons for the pronounced differences found are given. The physiography of each island is then considered in some detail, and a general description of the submarine features of the coast of California (particularly in the south) is also given. This is followed by a consideration of the chief conditions governing the formation and preservation of terraces and other wave-formed features. Finally, the most recent movements of the coast are considered, with the conclusion that the islands have moved in unison with the mainland.

An early geological excursion. By JOSEPH LE CONTE, Berkeley, Calif.

An informal narrative of a camping trip in 1844 to Lake Superior, thence up the St. Louis river, thence by portage into the upper tributaries of the Mississippi, thence down that river to Fort Snelling, thence by steamer to Galena, St. Louis, and Pittsburg, and finally by rail back to New York. The paper was of interest chiefly from a historical point of view. For example: The writer went to Lake Superior with the first mining party (Colonel Gratiot's) that opened the Lake Superior copper mines and camped with the party for three weeks at Eagle Harbor. After leaving Eagle Harbor on a canoe trip of about 800 miles, only three or four white men were seen. The canoe was drawn up on the very spots where Duluth and Minneapolis now stand, but many years before those cities existed. Many important geological observations were made and recorded for the first time, but the writer was too young to appreciate their full significance.

Some coast migrations, Southern California. By BAILEY WILLIS, Washington, D. C.

The sequence of events discussed in the paper includes (1) the development of the Santa Lucia series; (2) erosion of the Santa Lucia series; (3) deposition of the Franciscan conglomerate, sandstone and shale; (4) orogenic movements which resulted in profound deformation of the Franciscan formations; (5) deep erosion of the Santa Lucia and Franciscan rocks, which is partly represented in later sediments; (6) evolution of the present mountain system and coastal front. The paper presents observations made during a trip from Monterey to San Luis Obispo along the intervening coast ranges. The writer was accompanied by Dr. H. W. Fairbanks, in whose articles many of the facts presented have already been published.

The sandstone reefs of Brazil. By J. C. BRANNER, Stanford University.

The geological significance of soil study. By E. W. HILGARD, Berkeley, Calif.

This paper discusses, first, the importance and convenience of observations on soil areas and their characteristic vegetation, in the delineation of geological formations. It

then treats of the chemico-geological relations between the latest geological formations, soils, and the more ancient deposits which, after emergence, have been subject to subaërial agencies.

The American Devonian placoderms. By E. W. Claypole, Pasadena, Calif.

Following a detailed discussion of the structure and relationships of the principal Devonian genera of North American placoderms, the author presented his views on the habits, habitat, origin and migrations of the great armor-clad forms.

The Berkeley Hills—a detail of Coast Range geology. By Andrew C. Lawson, Berkeley, Calif.

A discussion of the geological history and structure of the hills in the vicinity of Berkeley, accompanied by a colored map on a scale of 1 : 12,000 and six geological sections.

Andrew C. Lawson,
Secretary.

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*PROFESSOR HENRY ALLEN HAZEN.**

By a sad accident on the evening of Monday, January 22d, the Weather Bureau lost one of its most prominent officials. Professor Henry Allen Hazen, while riding rapidly on his bicycle, hastening to his night work at the Weather Bureau, collided with a pedestrian and was dashed to the ground. After lying unconscious for twenty-four hours, he expired on the 23d. His body is interred in the family burying-ground at Deerfield, Massachusetts.

Professor Hazen was born, January 12, 1849, in Sirur, India (about 100 miles east of Bombay), the son of Reverend Allen Hazen, a missionary of the Congregational Church. He came to this country when ten years old and was educated at St. Johnsbury, Vermont, and at Dartmouth College, where he was graduated in 1871. After this, he removed to New Haven and was for four years instructor in drawing in the Sheffield Scientific School, and for four years subsequent was assistant in meteorology and physics under Professor Elias Loomis. He was also privately associated with the latter in meteorological researches and the preparation of many of the 'Contributions to Meteorology,' published by Professor Loomis, some of which bear evidence of the reflex influence of the student on the master.

In the spring of 1881, when the present writer first saw Professor Hazen in New Haven, the latter showed such an earnest interest in meteorology as to justify recommending him to the position of computer in the 'Study Room' which was then being organized by General William B. Hazen the Chief Signal Officer, for the purpose of developing the scientific work of the Bureau, as a necessary adjunct to its important practical work. After his entry (May, 1881) into the meteorological work of the Signal Service, Professor Hazen took a prominent part in this field. The special works assigned to him (such as the deduction of altitude by railroad levels, the study of the psychrometer, the proper exposure of thermometers, the study of thunderstorms, annual courses of lectures on meteorology), were by no means sufficient to absorb his energies, and we find him branching off into many other subjects, such as barometric hypsometry and the reduction to sea-level, the testing of anemometers, the study of tornadoes and the theories of cyclones, atmospheric electricity, balloon ascensions, the influences of sunspots and the moon, the danger lines of river floods, the sky glows and the eruption of Krakatoa. His enthusiastic advocacy of the importance of the balloon to meteorology was very highly appreciated. His five ascensions (1886, June 24, 25; 1887, June 17 and August 13; 1892, October 27), undoubtedly gave very accurate temperatures and humidities.

* From advance sheets of the *Monthly Weather Review.*

After the death of General Hazen and during the administration of General Greely, the computers of the Study Room became junior professors at a higher salary and were assigned to official duties of a broader aspect. In the course of such duties, Professor Hazen frequently took his turn as forecast official (beginning with October, 1887), and as editor of the *Monthly Weather Review* (beginning with December, 1888), while also acting as assistant in the Records Division. In July, 1891, in accordance with the terms of the transfer to the Department of Agriculture, he was appointed one of the professors of meteorology in the Weather Bureau, where he was at once assigned to regular and congenial duties in the Forecast Division.

Having shown that 'the Hazen thermometer shelter' was much better than the large close double louver formerly used, his form was adopted by the Bureau in 1885 and still remains in use. His experimental work with the sling psychrometer and dew-point apparatus was executed with great care and refinement, but the resulting psychrometer formula differs from those in current use in that it rejects the important term depending on the barometric pressure. Among his larger publications were: *The Reduction of Air Pressure to Sea-level* and *The Climate of Chicago*.

In addition to his official work in the Weather Bureau, Professor Hazen was a frequent contributor to meteorological and other scientific journals. He was one of the supporters of SCIENCE during the years 1882–89 and of *The American Meteorological Journal*, 1884–96. He also, published independently his 'Meteorological Tables,' and 'The Tornado,' and possibly other works. A complete list of his published writings would include several hundred titles.

It must be confessed that a peculiar temperament sometime led him to beliefs and statements in scientific matters unacceptable to his colleagues, but to which he adhered and on which he acted with such pertinacity that to some he occasionally appeared obstinate and headstrong; this was simply a result of the intense earnestness of his own convictions, which so completely absorbed his mind that there was no place for further considerations. However, the amiability of his character always prevented any enduring unpleasant feeling between himself and his associates.

C. A.

SCIENTIFIC BOOKS.

Annual Report of the Bureau of Steam Engineering of the Navy Department; 1899. Washington, Government Printing Office. 1899. Pp. 89. Many illustrations and working drawings.

The annual report of the Chief of the Bureau of Steam Engineering of the Navy Department, made up in advance of the compilation of the annual message of the President and reports of the heads of department for the information of Congress and the people of the United States, always contains interesting matter bearing upon applied science, although mainly devoted to the purely technical side of the work of that bureau. Admiral Melville is equally positive, direct and effective, whether at the Lena Delta seeking lost heroes, or in his office at Washington, and his report illustrates his character as well as his work. Passing over the purely technical accounts of the condition of the mechanisms of the naval war-engine, and of the fleets, the first subject of general interest is that of the recent consolidation of the two great corps, the engineer and the line officers, as effected by the 'personnel bill' of last year. Without explicit assertion of the fact, it may fairly be inferred, we think, that the Chief of Bureau is apprehensive lest the terms of the bill and its purpose may fail of complete accomplishment, the Department lacking that firmness and determination to obey and to make successful the conclusions of Congress regarding this important experiment. It is obviously an experiment and is no less obvious that it

may be made to succeed or to fail, accordingly as the officers of the Government, from the President and the Secretary of the Navy down to lieutenant and ensign, combine to insure its success or conspire to insure a failure. It will only be when every watch-officer, whatever his grade, is made an efficient officer, both above and below decks, that the modern naval fighting machine can be made of maximum efficiency under the existing system. Any disinclination of either of the old types of officer to become efficient in either old line of duty, results in serious, perhaps very dangerous, inefficiency, and a liability to failure at critical times. The conversion of the navy from a sailing to a steaming fleet, from an aggregation of sailing craft into a collection of floating machines of wonderfully complicated mechanism, cannot be reversed; but the change may prove most disastrous during the period of transition if every officer in the service does not display sufficient patriotism to insure rapid and safe metamorphosis. It is here that the real risk lies and the overcoming of confirmed habits, of prejudice, and any indolence of the personnel, by reason, sense and patriotism, must be relied upon to insure success.

The structural work of the navy has been greatly promoted by the introduction of a new structural material—nickel-steel; which alloy is now regularly furnished in any quantity and in parts of any size, from five pounds in a rifle-barrel to many tons in the shaft of a transatlantic or Naval steamer. This is an alloy of 'mild' steel, ingot-iron, with a small percentage of nickel, resulting in greatly increasing the limit of elasticity and the ultimate resistance of the metal, without sacrificing its ductility.

Electrically driven machinery has come to be an important and very extensive element in the construction and installation of details of the machinery of every man-of-war. The advantages, where allowable or applicable, are great ease of operation, convenience of energy-transmission, and especially avoidance of heat due to the transmission of steam to steam-driven machinery about the ship, and a considerable gain in economy, in many cases. The disadvantages are stated to be excessive weight, great delicacy, lack of adaptability to the conditions of everyday work at sea, and the occupation of spaces below the protective deck, where space is particularly valuable and difficult to secure for the apparatus of battle. The admiral thinks the advantages of electrical transmissions on shipboard somewhat exaggerated and that, within the machinery compartments, at least, 'steam-drives' are preferable. He refers to the curious fact that, in the navy, it has been the custom, very generally, to entrust the machinery of the electric transmissions to the non-expert departments of the organization. The experts in engineering are apparently called in only when the responsible amateur gets into trouble. As the presumably best-informed man in the navy, on this subject, the Engineer-in-Chief is entitled to most respectful consideration and a full hearing, when discussing these matters of fact and principle in engineering.

The transformation in type of the marine steam-boiler, from the older forms to the 'modern', 'sectional,' 'safety' or water-tube type, appears, in the judgment of the responsible expert authority of the navy, to have been practically accomplished—a change which was compelled as soon as the steam-pressures needed to insure the now common and high thermodynamic efficiencies of naval steam-engines had attained figures beyond the safe standards for 'shell' boilers of the old forms. Now that steam pressure is carried at from 15 to 20 atmospheres, the safer forms employed by Fulton and Barlow in 1798, by John Stevens 1804–5, by Trevithick in 1810, by Gurney and Hancock in 1830–35, and by them made successful in earlier generations and by Babcock and Wilcox and Root later, have come permanently into use. It is somewhat remarkable that they should have been first accepted so generally in the navy, where it has been a tradition that the traditional is best. The change is perhaps in part due to the introduction of a progressive spirit with steam, and certainly largely through the appearance on the scene of the young element now coming up from the great technical and professional school at Annapolis, where it has become imbued with the scientific spirit of the time.

R. H. T.

Bacteriology applied to the Canning and Preserving of Food Products. By EDWARD W. DUCKWALL. Baltimore, *The Trade.* 1899. Pp. xi + 111. 17 colored plates. 7 figures in text. Price, $5.00.

There is great need of a good manual of bacteriology in its applications to the food-preserving industries. The arts of refrigeration and sterilizing have probably done nearly as much as has improved transportation towards abating that unfortunate state of affairs described by Macaulay in which, owing to bad roads, it was no uncommon thing in England, in the seventeenth century, for the fruits of the earth to rot in one place, when only a score of miles away people were suffering from a scarcity of the very food which was spoiling almost within their reach. The author of this 'Bacteriology' is to be commended, therefore, for his recognition of this need and for his evident desire to meet it. The announcement of the work, however, aroused apprehension when it stated that "After some unavoidably long delays, due to the nature of the work which of necessity must be minutely correct and exact * * * the book you have been waiting for * * * is now ready * * * This work, handsomely bound in leather, and printed on heavy paper, contains 24 microscopical views of the living germs found in canned goods in their *natural color*, and just as they appear to the eye under the cover glass. The whole work is written with the express purpose of enlightening and teaching canned-goods packers and preservers of food-products the highest and most scientific method of handling all kinds of foods." It was not encouraging to be thus informed that we were to see 'views of the living germs * * * in their natural color,' and the appearance of the work itself has not been reassuring. A careful examination leads to the conclusion that it has been hastily and even carelessly prepared; that it is full of errors both of substance and form; and that the author, while enthusiastic in his appreciation of the importance of bacteriology to his favorite industries, is not himself a trained bacteriologist, but only an amateur filled with zeal rather than knowledge. If, as stated in the announcement, "the whole work is written with the express purpose of enlightening and teaching," it must be frankly said that it is not a success, and that there is danger that it shall darken rather than illuminate understanding among those for whom it was prepared. A few citations will suffice.

In describing certain microscopic observations upon sour tomatoes, the author says on page 2: "I found quite a number of small round globules, which at that time I was unable to understand. They seemed to be motionless, except a slight quivering which is termed Brownian motion. There were small rods and little fine dots sometimes alone, sometimes in pairs, and looked like ants. There were also small forms barely perceptible and one or two specimens of a very large germ. The view given in the accompanying plate is just as it was taken." The 'view' referred to shows some yeast-like bodies, bacilli and spherules, but the yeast cell walls are colored blue, and the contents of the yeast cells are a mixture of blue dots and red lines. Passing over a multitude of ill-digested and more or less muddy statements, drawn apparently from various authors, but rarely quoted with precision and seldom if ever attributed to the proper source, we may notice one of the more surprising statements in regard to the physiology of bacteria (p. 13): "Sometimes an acid is generated which will kill them, and that acid may be due to their own action. The condition will become favorable, too, when the organisms have performed their work." Of the butyric acid bacteria the author says (p. 20): "They are so small in this dried-up form that we can almost conceive of them being able to pass through the juice without becoming wet." And again, on p. 39, " * * * the flavor which is imparted to the beer and wine and the peculiar flavor of cheese and butter we know is due to the products of the butyric ferment, amylobacter." The serious blunder made in this statement appears in another place (p. 7): "The butyric ferment * * * is so useful in ripening cheese and making butter that this form is cultivated and employed in some of the best creameries."

In regard to Bacillus prodigiosus we find some equally astounding statements (p. 23): "This is the organism which gives the odor of herring brine or fish to putrefying substances, and is

also named 'bleeding bread' because it is a pigment bearing bacillus of red color, and forms spots when growing on bread, potatoes and onion that resemble blood. It is an egg-shaped germ about 1/25000 of an inch in diameter, which is very small * * *. This organism is very common * * *. The drawing here represented was taken from life * * *. [It] is also a germ causing unsoundness in bread and bakers have to guard their dough against this action to prevent souring * * *." The plate which occupies the page opposite this remarkable description is something wonderful to behold. Within a large ten-sided polygon indicated by a thin blue line we have a dozen or more of what appear to be long, stout bacilli or hyphæ, also blue, but showing a reticulum, or chromatin-like substance, of a bright red color. The main background of the field is nearly filled with small, oval, red-colored dots or circles, and besides these there are present n large numbers thin and almost invisible bluei lines which seem to be intended for delicate and very slender bacilli. The legend beneath reads: "Figure 13 Magnified × 1000. One part bouillon, 99 parts water. Rank putrefaction. Bouillon, prodigiosi." The whole effect of this plate must be seen to be appreciated.

Woodhead's excellent book on 'Bacteria and their Products' seems to have been the author's principal source of information, and if he had only quoted correctly, and copied Woodhead's figures with accuracy, there would have been little occasion for the present criticism. One of his worst blunders—to call it by no stronger term—is that in which the author gives as his 'Figure 19. Magnified × 1000. Kleles Loeffler Bacilli, × 1000,' a figure which so far as a careful comparison can determine is a copy of Woodhead's figure not of diphtheria, but of *anthrax* bacilli, and this, too, turned upside down. After discoveries of this sort the intelligent reader may be pardoned for regarding, with a certain cynicism, a rhapsody like the following (p. 31): "What a study it is, then, this science of bacteriology. It opens up a new world to us (*sic*) and we are permitted to gaze upon it and behold the scheme of Nature giving us object lessons day by day in the tearing down and building up process. Life begetting new life and new life flourishes on the dead; seed developing into form, form producing seed, decay of form, and development of seed. This is true of the germ and also of every living thing." As we peruse this strange deliverance we are compelled to agree with the author that form, here at least, readily goes to seed and even to rot.

It would be easy to extend the present review, but the whole work comes dangerously near to a burlesque of bacteriology and extended comment is unnecessary. Only one point more need be made. The author evidently quotes extensively from various writers and investigators without giving them credit. For the most part these statements have long since become the common property of bacteriologists, but toward the end of the book he apparently uses freely the recent and important monographs of Messrs. Prescott and Underwood, of the Massachusetts Institute of Technology, on the history of the canning industry and on bacteriological investigations of canned foods, especially of sour corn, of which a preliminary account was published in SCIENCE, Nov. 26, 1897, and yet never once mentions these authors.

We are tempted to close with the familiar warning that a little knowledge is a dangerous thing, and a reminder to those into whose hands the book may fall that blind leaders of the blind are apt to be untrustworthy. The author himself, in discussing the vacuum which exists in most well prepared and hermetically sealed food-cans, has, however, given utterance to a similar warning, in quite original metaphor: "We thus see that packers who are pinning their faith to a vacuum are depending upon a broken reed." Those who pin their faith to the author's kind of bacteriology will, we fear, discover to their cost that they are leaning not even upon a broken reed, but only upon a vacuum.

BOOKS RECEIVED.

Lehrbuch der Botanik für Hochschulen. EDUARD STRASBURGER, FRITZ NOLL, HEINRICH SCHENCK, A. F. W. SCHIMPER. Jena, Fischer, 1900. Fourth revised edition. Pp. viii + 588. 7 Mark, 50 Pf.

The Nature and Work of Plants. DANIEL TREMBLY MACDOUGAL. New York and London, The Macmillan Company. 1900. Pp. xvii + 218. 80 cts.

A Manual of Zoology. C. JEFEREY PARKER and WILLIAM A. HASWELL. New York and London, The Macmillan Company. 1900. Pp. xxv + 563. $1.60.

Optical Activity and Chemical Composition. H. LANDOLT, translated by JOHN MCCRAE. London, Whittaker & Co.; New York, The Macmillan Company. 1899. Pp. ix + 158.

The Refraction of the Eye. A. EDWARD DAVIS. New York and London, The Macmillan Company. 1900. Pp. xii + 431. $3.00

SCIENTIFIC JOURNALS AND ARTICLES.

The Osprey for January begins with a paper by Paul Bartsch on 'Birds of the Road,' which is followed by an illustrated article on 'Esthetic Birds; The Bower Birds of Australia and New Guinea,' by Theodore Gill. Under the title, 'The Birds of the Hawaiian Islands,' Leonhard Stejneger reviews Scott Wilson and Evans' monograph of the Hawaiian birds and discusses some of the many interesting points connected with the avifauna of the islands. Charles E. Beecher contributes a sketch of 'Othniel Charles Marsh as an Ornithologist,' and gives a list of the fossil species described by him. The editorials contain some interesting statements as do also the notes.

Bird Lore for February opens with a brief, but appreciative biographical sketch of the late Dr. Coues, accompanied by an excellent portrait. Frederic A. Lucas contributes an illustrated article, 'Concerning Birds' Tongues,' and Frank M. Chapman has a 'Note on the Economic Value of Gulls,' which includes a very beautiful picture of a group of kittiwakes. A list is given of '*Bird Lore's* Advisory Council,' whose members have consented to assist students by responding to their requests for information. Lynds Jones discourses 'On Methods in Teaching Ornithology at Oberlin College' and W. H. C. Pynchon has a paper on 'Every-Day Study of Birds for Busy People.' Morgan St. John (aged 12) has an article on 'February Birds,' which shows that good observations may be made by a young observer. There are numerous notes and book reviews, and in the editorial department the question of bird protection is discussed at length.

The Plant World commences its third year with the January number and announces that a series of articles by Mr. Pollard on the families of flowering plants will appear as supplements to each number. C. F. Saunders describes the 'New Jersey Pine Barrens in July,' Wm. T. Davis has some 'Observations on a Woodland Fire,' and C. A. Crandall under the caption 'The Fall Green Orchis (*Habenaria hyperborea*) visited by Mosquitoes' tells how these insects assist in the pollination of this plant. V. K. Chestnut discusses a 'Fatal Case of Amanita Poisoning' and Mrs. Caroline A. Creevy continues the series of articles on 'Plant Juices and their Commercial Values.'

McClure's Magazine for October contained a short story entitled 'The Killing of the Mammoth,' which was taken by many readers, not as fiction, but as a contribution to natural history. Numerous requests for information have been received by the Smithsonian Institution and the editors of the magazine. To explain matters, the editors have inserted in the issue for February an interesting and excellently illustrated article by Mr. F. A. Lucas of the U. S. National Museum, entitled 'The Truth about the Mammoth.'

SOCIETIES AND ACADEMIES.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

THE 511th meeting of the Society was held at 8 p. m., on January 20th at the Cosmos Club, Surgeon General Sternberg, presiding.

Under the head of Informal Communications Professor T. J. J. See of the Naval Observatory, presented the results of his researches on the orbits of the Double-Stars τ Cygni and 95 Ceti. The substance of the paper was as follows: No good orbit of either star has been determined by previous investigators. The period of τ Cygni was found to be 57 years, and the eccentricity 0.37. The companion, which is always very difficult, has passed through periastion, and is slowly becoming easier to observe. 95 Ceti is the most difficult of known Double-Stars, and only a few measures have been made by previous observers. So many unsuccessful attempts had been made by Burnham and others during the last twenty years to separate the small star, that some astronomers

had reached the conclusion that the system is in very rapid motion, with a period of perhaps less than ten years. But the recent measure secured by Professor See with the great Equatorial of the Naval Observatory, combined with others taken by him with the Lowell telescope in Arizona in 1897, show that the System in fact revolves slowly with a period of about 150 years. The present position-angle is 157°, and the distance 0.33. As the components are of the 6th and 11th magnitudes, the difficulty of the investigation is apparent. This star has not before been seen at Washington, and Professor See's success in observing it led him to think the seeing here is occasionally very good indeed. As the companion of 95 Ceti will remain at a constant distance for about 20 years it forms a test object for telescopes which will prove a useful criterion for observers.

The first regular paper was by Dr. Hyvernat, Professor at the Catholic University of America, who made a tour last summer in Syria for the purpose of ascertaining the cause of the perennial fountains so numerous in the Middle Region, or Wusut, of the Lebanon System. Special attention was given to the Province of Kesrawan which he explored from west to east, following the Nahr-el-Kelb and its chief tributary, the Nahr-el-Zalib, until he arrived at the Sannin Group. He discovered that the juncture of the main with the side-ridge, which runs in a northwesterly direction between the basin of the Nahr-el-Kelb and that of the Nahr-Ibrahine, forms a table-land sloping towards the north-west and studded with gigantic, rocky knobs. Between these knobs are numerous holes in the shape of craters, or funnels, filled with snow. Finding these holes entirely without outlet on the sides and without an exception, free from water, Dr. Hyvernat came to the conclusion that as the snow melts, the water filters immediately through fissures in the underlying rock and appears again at the foot of the High-Mountain, or Jurd, in the form of the aforementioned fountains. This to him seemed a better solution of the question of the origin of the fountains, than the theory of the condensed vapors, put forth by many geographers. Completing his own observations from those of E. H. Palmer and R. F. Burton, the lecturer remarked that Mount-Lebanon offered very likely the most extensive system of perennial fountains fed by 'snow-swallowing' holes. Dr. Hyvernat showed quite a number of specimens of geology, particularly from the lower cretaceous and the Nubian sandstone.

The second paper was by Mr. Mitchell Carroll on 'Recent Excavations in the Roman Forum.' Mr. Carroll said that the excavations in the Roman Forum, conducted during the past year under the direction of Signor Guido Bacelli, Minister of Public Instruction, and with Signor Giacomo Boni as superintendent, have shown gratifying results, especially in three directions: First, in the removal of mediæval and modern accumulations from certain ancient structures, and in the collecting and classification of the architectural fragments scattered about in the Forum; second, in the reconstruction of the temple of Vesta and *Ædicula* adjacent to it, and of a number of the honorary columns, whose pedestals front the Basilica Julia; and third, in the excavation of the area of the Comitium bordering on the Forum which has led to the discovery of what purports to be relics of the period of the Kings. These are: the 'Niger Lapis,' popularity designated the 'Tomb of King Romulus'; archaic votive offerings, (such as a terra-cotta tablet, bronze figurines, etc.); and above all in importance, a stelé, bearing an archaic inscription, supposed to date from about the middle of the seventh century, B. C. The lecture was illustrated by lantern slides showing the progress of the work.

E. D. Preston,
Secretary.

Geological Society of Washington.

The 96th regular meeting was held at the Cosmos Club, January 24, 1900.

The following papers were presented on the regular program.

(1) Mr. C. W. Hayes: 'Solution Sinks in a Quartzite Formation.'

Two circular depressions, 150 feet in depth, occur on the southern flanks of Coldwater Mountain in Alabama. These depressions have all the characteristics of solution sinks. The rocks in which they occur are lower Cambrian quartzites and sandstones, the upper beds of

the Weisner formation, which has a thickness of several thousand feet. The explanation offered for these sinks is that the beds in which they occur have been faulted over beds of limestone, and the material which originally occupied the depressions has fallen into underground channels through which it was carried off by flowing water.

(2) Mr. J. E. Spurr: 'Structure of the Basin Ranges.'

This paper describes the structure of many hitherto unstudied ranges in southern Nevada. The general structure is a series of open regular folds, with general north and south axes, accompanied by occasional parallel and transverse faults. Folding and faulting have gone on continuously since the region was upheaved at the close of the Jurassic. The present mountains owe their forms chiefly to erosion, which has been in progress, synchronously with the folding and faulting, since Jurassic time. The more common types are anticlinal ridges and synclinal valleys. The mountains are the compound result of erosion on rocks upheaved by these compound movements.

F. L. RANSOME,
DAVID WHITE,
Secretaries.

NEW YORK ACADEMY OF SCIENCES.

SECTION OF GEOLOGY AND MINERALOGY.

AT the meeting on January 15, 1900, with Mr. G. F. Kunz in the chair, there were twenty persons present.

A report was presented by Professor J. J. Stevenson in behalf of the committee appointed November 20, 1899, in reference to the death of Sir William Dawson, of Montreal. On motion by Professor D. S. Martin, the report was adopted and recommended to the Council for printing.

The Chairman called attention to the coming meeting this year, in Paris, of the Eighth Session of the International Geological Congress, described the proposed excursions, and suggested the earnest coöperation of the Section by delegates, contribution of papers and financial aid. On motion by Professor J. F. Kemp, the matter of the representation of the Academy at the International Congress was referred to the Council for action.

A paper was read by Professor F. B. Peck 'On Serpentines and Talcs in the Vicinity of Easton, Pennsylvania,' with abundant illustrations by specimens of rocks, diagrams and lantern views.

In the subsequent discussion Professor Kemp stated that, in the talc deposits on the west side of the Adirondacks, described by Professor Smyth, the derivation of the talc had been attributed to the magnesium limestone or intrusion of a magnesium silicate rock.

Professor Peck replied that he considered the tremolite rock to be due to the alteration of a siliceous dolomite; the talc, possibly to the interchange of silica from the pre-Cambrian gneisses and magnesia from the adjacent dolomite limestone.

The serpentine and 'viridolite' had indeed been subjected to much shearing and fracture, but had been solidly re-cemented, so that they they could be quarried out in large blocks, free from cracks—sometimes of twenty tons weight, in the case of the 'viridolite.'

Professor J. J. Stevenson then discussed 'C. E. Bertrand's Theory respecting the Origin of Certain Coals.'

Mr. F. E. Lloyd remarked that the cells of algæ, to whose accumulation Bertrand and Rénaud mainly attributed the formation of these coals, are exceedingly delicate and often mucilaginous. Those of *sphagnum* are much thicker, solid and woody, and yet a large quantity of this is required to produce much deposit of carbonaceous matter in swamps.

The Chairman inquired whether freezing or the introduction of silty waters might cause the precipitation of ulmic acid referred to by these authors.

Professor Stevenson stated that ulmic acid so precipitated would tend to carry down suspended matters and to clear the waters.

A paper by Mr. H. Ries was then read, 'Note on the Occurrence of Allanite in the Yosemite Valley, California.'

While in the Yosemite Valley in September, 1899, my attention was attracted by a black, coaly-looking mineral in the pegmatite veins on the northwestern side of the Valley. On closer

inspection the mineral proved to be allanite, and as it has not yet been recorded from this region, it seems of interest to note the fact.

The rock forming the walls of the Yosemite is a grano-diorite according to Turner (17th Ann. Rep. U. S. G. S., pt. I., p. 710). Traversing this in many directions are veins of pegmatite, which are sometimes straight and unbroken, at others curved, branched, or even broken into. These pegmatite veins are very prominent on the face of El Capitain, and also in the rock forming Eagle Peak. It was in the talus at the foot of the latter that the allanite was found, and while the mineral was at times abundant in the pegmatite blocks, still none of it was noticed in the grano-diorite. In only one instance was a distinctly bounded individual found, and on this a combination of orthopinacoid and base were recognizable. The other specimens were irregularly bounded grains that varied from a sixteenth to a quarter of an inch in diameter.

In addition to the quartz, muscovite and orthoclase present in the pegmatite, there were a number of radiating masses of epidote, which were evidently of primary origin; but in two instances the epidote occurred as a coating on hornblende and then seemed to be secondary. None was found in association with the allanite.

In conclusion, it may be said that it is interesting to find that allanite is evidently not the rare mineral that it was formerly considered to be, and that a careful watch is beginning to show its presence at many localities in the United States.

Alexis A. Julien,
Secretary of Section.

ONONDAGA ACADEMY OF SCIENCE.

At the January meeting the following officers were elected: *President*, John Van Duyn; *Vice-President*, J. D. Wilson; *Recording Secretary*, E. N. Pattee; *Corresponding Secretary*, H. W. Britcher; *Treasurer*, Miss L. W. Roberts; *Librarian*, Mrs. L. L. Goodrich; *Councilors*, G. A. Dakin, H. A. Peck and W. M. Beauchamp.

The annual report of the Geological Section showed that several investigations of local problems are being carried on and that some have been already completed during the year.

The report of the Zoological Section noted the occurrence within the county during the past year of the Bohemian wax wing, *Ampelis garrulus*, the jumping mouse, *Zapus hudsonius* and the hairy-tailed mole, *Parascalops breweri*. Additional localities were indicated for planaria, bryozoa and hydra. During the year fifty moths were taken, thus bringing the number of Lepidoptera of the county to over 600.

The report of the Botanical Section added the following plank to the county list: *Hyssopus officinalis*, *Chenopodium anthelminticum* and *Polygonum lapathifolium* with new stations for *Crepis virens*, *Glaucium glaucium* and *Scolopendrium*.

At the January meeting of the Geological Section, Professor E. N. Pattee reported on the progress of the investigations of the iron compounds of the county. The chief sources of these compounds are the red shales of the Salina formation, yielding small scales and flakes of hæmatite, the Corniferous, yielding crystals of pyrite and the Oriskany sandstone, yielding from one to five per cent. of iron, the color of the stone being, however, no index to the amount of iron, existing as a cement, which the rock contains.

H. W. Britcher,
Corresponding Secretary.

THE TEXAS ACADEMY OF SCIENCE.

During the last quarter of 1899 regular meetings of the Texas Academy of Science were held in the chemical lecture room of the State University on the second Friday evening of each month.

On October 13th, after a proper tribute to the worth and work of the late Dr. W. W. Norman, Professor of Animal Biology in the University and one of the most active members of the Academy, in which Messrs. Bray, Harper, Garrison, Sutton and others participated, Dr. Frederic W. Simonds, the incoming president, read his inaugural address, 'From the Standpoint of a Man of Science,' in which he made a vigorous protest against sham in all things, but especially in science, and an earnest effort to explain many of the popular misunderstandings of science and misconceptions concerning men of science and their work.

At the October meeting, Professor W. S.

Sutton, of the School of Pedagogy, read a timely and exceedingly interesting paper upon the 'Bachelor of Arts Degree,' in which he showed the origin of this ancient honor and its evolution until at the present time it stands for culture, and, in several prominent American institutions, has even become the sole mark of academic training.

The program for the December meeting was of two parts. The first, representing original investigation, consisted of two papers by Mr. E. T. Dumble, formerly State Geologist, entitled 'Cretaceous of Obispo Cañon, Sonora,' and 'Occurrence of Oyster Shells in Volcanic Deposits in Sonora, Mexico.'

Part second was of the nature of a symposium, in which the advancement of science during the past year occupied a conspicuous place. Dr. William L. Bray, discussed the 'Modern Trend of Botanical Studies,' showing clearly and forcibly the enormous strides made within the last few years; he pointed out the differentiation of the science of botany—how it had outgrown the grasp of any one man—and spoke briefly of its economic relations to many important industries.

Dr. Henry Winston Harper discussed the 'Recent Advances of Chemistry.' The solidification of hydrogen was, in his opinion, the most important chemical contribution to science during the past year. From a thermo-dynamic standpoint it is one of the greatest accomplishments of the nineteenth century, as it requires a temperature within 15° C. of the absolute zero. The study of the properties of matter at such extremely low temperatures is a virgin field for original investigation and phenomena of a most startling character may be looked for here. Some of the results of the latest research along this line were brought before the Academy. The advances of chemistry along many other lines were also discussed, especial stress being given to the recent utilization of the Indian corn plant, or maize, not only of the grain, but of the entire plant—pith, stalk and leaves. Professor Harper closed his discussion by reference to some recent developments of chemical theory, devoting particular attention to 'Werner's Theory of Coördinated Types.'

At a meeting of the Council, following this public session, Drs. Hilgartner, Bray and Bailey, were elected a Committee on Publication.

F. W. S.

UNIVERSITY OF TEXAS.

DISCUSSION AND CORRESPONDENCE.

FALSE BIBLIOGRAPHIC INDICATIONS.

TO THE EDITOR OF SCIENCE: For some years past a few scientific Hamlets have been trying to set the time right in the matter of 'authors reprints,' 'Separat-abdrücke', or 'tirages à-part.' The most essential of their demands is that such separate copies should be furnished with correct bibliographic indications, and should retain the original page-numbers. They recognize with gratitude that the last ten years have witnessed a vast improvement in this respect. But a new terror has arisen, and appears so frequently and in so many quarters that it seems time to raise a vigorous protest.

It is not uncommon to be favored by an author with a copy of his latest work giving the desired bibliographic indications—name of periodical, volume, page, and plate numbers, and date of publication—and apparently with the type undisturbed. But should some chance lead one to the original, one finds that one or more, perhaps all, of these indications are incorrect; or else that the type has been shifted, so that matter appears on a page other than that which it originally occupied. Direct misstatements of this specious nature are worse than no statement at all.

It is not gracious to look a gift horse in the mouth, but some instances will make the point clearer and may serve as a warning. Be it understood that this is no question of mere incompleteness of information, simple repaging, or even incorrect dating, for examples of these offences are familiar to every serious worker and are remedied by him in due course. But take such a case as this: "Studier öfver den baltiske Yngre kritans bildningshistoria. Af Anders Hennig. Aftryck ur Geol. Fören i Stockholm Förhandl. Bd. 21, Häft 1., 1899." The pagination runs from 19–82, and appears to be, as indeed it is, the original pagination. Then comes 'Häft 2' and the paper is said to be continued from the preceding 'Häft.' The pagination also continues, 83–138. There is

nothing to show that this is not the original pagination, and only the reader who chances to look up the original will find that the numbers should be 133–188 (with an addendum, not in the author's copy, on p. 218). Familiarity with the publications of the Stockholm Geological Society might arouse suspicion of the above. Let us turn to a case which seems a veritable Caesar's wife, extracted, as it is, 'from the Proceedings of the International Congress of Zoology, Cambridge, 1898,' edited by a very important person and printed by the University Press. It is 'On the Origin of Echinoderms, by Professor E. W. MacBride.' It bears all the characteristic signs of having been lifted without a tittle of alteration from the *Proceedings*, and the page numbers are 141–147. But in the *Proceedings* this paper appears on pp. 142–148.

Our next awful example hails from a Society which has done much to facilitate the work of zoologists: "Accidents will happen, etc." The paper is "Troisième note preliminaire du yacht *Princesse-Alice* * * * par E. Hérouard. Extrait du *Bulletin de la Société zoologique de France*, tome XXIV. * * * page 170." The pages of the extract continue regularly to page 176. Imagine the disgust of a Zoological Recorder, after entering all the new species-names on his slips, when he discovers by the merest chance that the original pages are 170–175 (not 176 at all) and that the type on every single page has been shifted. The converse of this Procrustean trick has been played upon "Notes biologiques sur quelques espèces d'Alphéidés observés a Djibouti, par H. Coutière. Extrait du *Bulletin du Muséum d'histoire naturelle*, 1897, no. 8, p. 367." The original pages, up to 370, are carefully given in [ ], and who would guess that there was ever a page 371, or that half of the text was on its wrong page? It is almost fortunate that the omission of the volume number and of the date of publication forces one to look at the *Bulletin* itself, and so discover the error.

After this one does not wonder at the following enigma recently received from a British Colony: "On some Cambro Silurian and Silurian Fossils from Lake Temiscaming, Lake Nipissing and Mattawa, by Henry M. Ami. * * * Extra. Ann. Rep. Geol. Surv. of Canada, Vol. X, Part I, Appendix II, pp. 282–301, Ottawa; Sept. 1899." Thus runs the wrapper. The title in the text adds "outliers" to the title; but a wrapper-title is not supposed to be correct. (*Why* not?). The pages of the text are 2891–3021. These figures are not merely irreconcilable with those on the wrapper, but suggest that "Part I" does not mean "Part One" at all, since the I is probably intended as a letter of the alphabet not as a Roman numeral. But this riddle is not yet solved, since the *Report*, here said to have been published four months ago, has not yet crossed the Atlantic.

These instances have not been selected for their intrinsic importance, but just as samples, all received within a few days of one another by a single individual. Each in itself seems trivial, but even a professional in touch with the best libraries in the world will be lucky if he can correct these five references in less than an hour. If he innocently accepts them he must not be surprised if he is abused some day as a careless worker, and his purely scientific observations mistrusted. If he incorporates them in a professed bibliography, the accuracy of his work will ever after be suspected and its value thereby seriously impaired.

Now the *fons et origo malorum* is not the author, who has very little to say in the matter, but the printer with his curious conventions of space and form, and his excusable ignorance of the needs of the working naturalist. The remedy lies, if anywhere, in the hands of the editor: he, who has the power, should also accept the responsibility. If the editors of our scientific publications would but realize the perpetual inconvenience that is caused by a little want of thought, and would but give clear and definite instructions to their printers to place the required bibliographic indications at the head of each reprint, to retain original pagination, and never to shift the type without duly stating the fact—then the amount of time saved by the numerous workers who have to rely upon authors' copies would be far greater than most people have any idea of.

F. A. Bather.

Natural History Museum,
London, 20 Jan., 1900.

FOSSIL-HUNTING IN WYOMING.

EDITOR OF SCIENCE: An article on 'Fossil-hunting in Wyoming,' published in the January issue of *The Cosmopolitan*, contains some inaccuracies which ought to be corrected. The present writer feels called upon to make these corrections. As many of the illustrations used in the *Cosmopolitan* article were from photographs of the Field Columbian Museum quarries, the erroneous impression has gone out in certain quarters that members of this institution were responsible for some of the misstatements, especially one which has been interpreted as a reflection upon a man to whom the science of paleontology owes much. I wish, therefore, to give a brief history of the discovery and collection of Dinosaurs in America, which I have sought to make as accurate as possible. The data regarding their discovery and early collection have been furnished me by Dr. Williston, whose association with Professor Marsh during his early work upon the Dinosaurs places him in position to speak authoritatively.

The first Jurassic fossil discovered in America was described in 1870 by Leidy under the name *Antrodemus* (*Labrasaurus*, Marsh, *fide* Lucas). Professor Arthur Lakes of Golden, Colorado, was, however, the first to recognize and appreciate the value of the deposits. In March, 1877, he located the horizon near Morrison, Colorado, and immediately sent specimens to Professor Marsh. Almost contemporaneously but a little later, fossils were discovered at Cañon City, Colorado, by O. Lucas, a teacher, and in Wyoming by W. H. Reed, a section foreman on the Union Pacific railroad. Reed, however, did not make known his discoveries until the following autumn and so forfeited any claim to priority.

In December of the same year Dr. Williston, who had been collecting for Marsh at Cañon City and later at Morrison, was sent to investigate the discovery reported by Reed at Como, Wyoming. Under his directions and assisted by Reed, quarry 1. of the Como series was at once opened and the work continued until late in the winter. During the succeeding years collecting was actively carried on in the Como region and as many as thirteen quarries in all were opened by the various men who had charge of the work. Collecting was carried on exclusively by Marsh for two or three years, at the end of which time Cope sent men into the immediate vicinity. After the Como quarries were abandoned, no collecting was done in the Jurassic beds for a number of years and the impression went out that the locality was exhausted. Interest in the beds was, however, revived by Professor W. C. Knight of the University of Wyoming, and W. H. Reed, who as early as the summer of '94 located and opened a new quarry at Mexican Mines, Wyoming. In the following summer Dr. Williston with a party from Kansas University was invited to share with them their new prospect. In '96 collecting was continued by the University of Wyoming in the Jurassic beds south of Laramie. In the spring of '97 the American Museum of New York sent men into the old Como locality to reopen Marsh's mammal quarry; but finding more promising material in the Dinosaur beds, their attention was turned to them. About the same time Knight's men opened quarries in the Freeze-out Hills. During the following year collecting was actively carried on by these two parties in their respective localities, and valuable quarries opened by both.

In '99 unusual attention was attracted to the Dinosaur beds of Wyoming by various press reports more sensational than accurate. In addition to the two institutions which had been carrying on active work, parties were sent out by the University of Kansas and by the Carnegie and Field Columbian museums. The Union Pacific railway also organized an excursion to the fossil fields, which brought not only paleontologists and geologists, but men interested in almost every branch of natural science to look at this new Eldorado. Among the new quarries opened during the year, those of the Carnegie Museum and Kansas University proved especially productive.

The valuable deposit worked out by the Field Columbian Museum party had not previously been passed over by 'a Kansas University professor,' as stated by the author of the *Cosmopolitan* article. On the contrary the quarry had been located and worked for some time by the Kansas University men. After they had taken out a large quantity of unusually good material

and returned home, the Field Museum party made a new stripping beside the old and obtained from it large additions to its summer's collection. Photographs of the fossils exposed in the various stages of the work of this party formed the subjects of many of the illustrations used in the *Cosmopolitan* article.

Elmer S. Riggs.

Field Columbian Museum.
January, 23, 1900.

CURRENT NOTES ON PHYSIOGRAPHY.

PHYSIOGRAPHY OF JAMAICA.

In connection with his studies of coral reefs, Mr. Alexander Agassiz has had surveys made of several West Indian islands by R. T. Hill, whose latest report is on the 'Geology and Physical Geography of Jamaica' (Bull. Museum Comp. Zool., Harvard College, xxxiv, 1899, 256 p., xli pl., including a topographical and a geological map). The island contains an interior mountainous area (the Blue mountains, 7360 feet), of greatly deformed rocks and of well subdued and elaborately carved form, occupying about one-sixth of the total area, chiefly in the east. A limestone plateau, whose gently arched strata were deposited unconformably upon the denuded older rocks during a period of submergence, rims around the eastern mountains and covers the central and western parts of the island to heights of 3000 feet; it is terminated toward the coast by strong bluffs, often terraced, 1200 feet high on the north. Below the bluffs, low plains descend gently to the sea. Solution has exerted great control over the drainage of the plateau, as may be seen in the interesting series of depressions, from incipient hollows of small size, to deep 'cock-pits' or sink-holes, and great basins, walled in by strong cliffs. Some of the basins still have underground drainage; others discharge their waters through canyons that have been formed by the retrogressive erosion of exterior rivers; while still others have lost their outer wall by the greater advance of erosion, subaërial or marine, and now form amphitheaters open to the coast. Inliers of older rocks sometimes rise in mountain form from the floor of the larger basin, as in Clarendon valley in the center of the island. The strata of the coastal plains lie on denuded benches of limestone or older rocks; their surface is diversified by coral reefs and transverse valleys, the first deposited, the second eroded during the time of elevation. The largest plain is that of Liguanea, upon which Kingston is situated.

The geological structure and history of the island, and its relation to the surrounding regions are fully discussed.

NICARAGUA CANAL ROUTE.

No article recently published gives better illustration of the practical value of the explanatory or genetic method in geographical description than that by Hayes on the 'Physiography of the Nicaragua Canal route' (*Nat. Geogr. Mag.*, x, 1899, 233–246; see also Science, x, 1899, 97–104). One feels on reading it that the author has critically observed the salient facts and that his account of them fully expresses the results of his observations. The region described may be divided into three parts: The upland traversed by the San Juan river from Lake Nicaragua eastward to the Carribbean, the basin of the lake, and the upland or continental divide that separates the lake from the Pacific. The eastern upland is part of an uplifted and dissected peneplain, 100–200 feet above sea level, and bordered by hills and mountains on the north and south. Its revived streams still run nearly at the upland level in their upper courses; then they descend rapidly in young valleys that they are still deepening to aggraded alluvial floors, which suggest a recent depression after the time of first valley cutting. The lake now stands where a bay once opened northwest to the Pacific; the eastern upland was then the continental divide. The bay seems to have been formed by warping or faulting a western portion of the peneplain above referred to. Numerous volcanic cones grew on the bay floor and converted its head into the lake, whose level rose until an eastern overflow formed the San Juan river, now cutting a trench across the eastern upland. The southwestern barrier of the lake seems to be another part of the peneplain, warped so as to give a steep descent to the Pacific and a gentler descent to the lake. On account of the unequal slopes thus determined,

several Nicaraguan streams have lost their headwaters to the Rio Grande, which enters the Pacific at Brito; and the point where one of the now beheaded Nicaraguan rivers rises on its old valley floor is the lowest pass on the present continental divide, and hence is selected for the path of the canal from the lake to the ocean. A fuller discussion of the region is given by the same author in *Bulletin of the Geological Society of America* (x, 1899, 285–348).

THE PLAINS OF RUSSIA.

A NOTE in SCIENCE, May 2, 1898, was in error in describing the plains of central Russia as dipping under the drift sheet on the northwest. The plain is continuous across the older rocks and the drift sheet of the first glacial invasion, and both areas are to-day dissected similarly by valleys. Philippson returns to this subject (*Pet. Mitt.*, xlv, 1899, 269–271) to emphasize his conclusion that the paleozoic and mesozoic area of the plain is a surface of denudation, now broadly uplifted and somewhat dissected; the denudation being completed contemporaneously with the formation of the drift plain. The rivers may have followed shallow depressions in the surface of the great plain, but the valleys of to-day are undoubtedly the work of erosion after uplift, and hence all of quaternary date. Even the broad and unsymmetrical valley of the Volga is held to be of later origin than the first glacial epoch. Small rivers have cut valleys 100 meters deep, either entirely in the older rocks, or in the drift area, or passing back and forth from one to the other. Most of the valleys are of a considerable width already, with well graded floors; but where the Dneiper crosses the granite swell of southwestern Russia there are rapids in its course. Philippson urges that the solution of morphological problems of this kind should not be postponed until the completion of detailed geological surveys, but that they should be studied during the prosecution of the surveys; he also wishes fuller information from the Russian geologists concerning the date of folding in the Urals and of their later upheavals after extensive denudation.

THE AMALFI LANDSLIP.

THE Boston *Transcript* of January 13th gives a translation from an Italian newspaper, *La Tribuna*, describing the landslip at Amalfi on December 23d, last. For several days preceding the disaster a trembling motion had been noticed in the mountain over the town and many peasants had left their houses. Early on the morning of the 23d, a noise like that of splitting wood was heard in Hotel Santa Caterina on the mountain slope, and a crack was found in one of the walls. A man from a quarry brought news that a small fissure had opened in the mountain side. Soon afterwards stones began to roll down the steep slope at more and more frequent intervals, and then a mass of rock estimated at 30,000 cubic meters broke away from the mountain and fell with terrible noise, crushing everything in its way and raising a dense cloud of dust. Some peasants working on the upper slope saw a long fissure open 'beneath their feet' and had only time to leap aside before the ground on which they had been standing broke away and fell. Others working at a lower level were killed. The sliding mass swept away a peasant settlement on the upper slope, buried the Hotel Caterina, crushed one end of the old monastery known now as the Hotel Cappuccini, a favorite resort of travellers, and then ran into the sea, destroying two boats, capsizing two others, and obstructing the shore waters. The highway near the shore was covered and all travel on it was suspended for fear of later disasters. Along the track of ruin for some distance up the mountain side, houses are demolished, trees uprooted, and gardens overwhelmed. A number of lives were lost, and the damage is estimated at over 1,000,000 lire.

W. M. DAVIS.

CURRENT NOTES ON METEOROLOGY.

A NOTEWORTHY BALLOON VOYAGE.

AN interesting point in connection with a recent balloon trip is noted in the *Zeitschrift für Luftschiffahrt* for December. The trip in question was made by MM. de Saint-Victor and Mallet, starting from Paris on September 30th last, at 6:15 p. m., and landing near Vestewick, in Sweden, on the evening of the following day. The duration of the trip was 23¼ hours, and the distance passed over was 1330

kilometers, or about 825 miles. The point referred to concerns the effect of a water surface upon the temperature of the air at the altitude of the balloon (about 500 meters). At about 9 a. m. on October 1st the balloon began to drift over a part of the Baltic Sea, and the aëronauts at once noticed a fall in temperature and an increased humidity in the air through which they were moving. In consequence of these changed conditions, the balloon began to descend, and it was necessary to throw out ballast in order to maintain it at a proper altitude.

THE BAGUIOS OF THE PHILIPPINE ISLANDS.

In the *Monthly Weather Review* for October, Abbe notes that in speaking of tropical cyclones, the word *cyclone* should uniformly be employed for all revolving storms, or else that names should be used which have a widespread local usage. Thus the term *hurricane*, which has its root in the Carib word *ourgan*, should, at least in English works, be restricted to the violent tropical cyclones of the North Atlantic Ocean. *Typhoon* has been the recognized designation of the revolving storms of the China Sea for many years. And now the term *baguio*, which is commonly used by the Tagalogs and Viscayans seems likely to come into use. *Baguio* is the name universally applied in the Philippine Archipelago to the storms that, after they pass westward over the Archipelago, become *typhoons* on the coast of China.

THE DROUGHT IN INDIA.

It has for some time been the custom of the Indian Meteorological Department to issue long-range forecasts of the monsoon and cold weather rains in India. From *Nature* for January 11th we learn that this year the forecast of the cold weather (December–February) rains in northern and central India anticipated a rainfall slightly above the normal. The prediction has unfortunately not been verified, as an area comprising nearly two-thirds of India is now suffering from the most severe drought of the century, and there does not seem, at present, to be any immediate chance of a change for the better.

METEOROLOGICAL CHART OF THE GREAT LAKES.

There has been issued by the Weather Bureau a publication entitled *Meteorological Chart of the Great Lakes: Summary for the Season of 1899*, by A. J. Henry and N. B. Conger. This quarto pamphlet summarizes the information contained in the monthly meteorological charts of the Great Lakes, issued throughout the navigation season. The discussion concerns the storms of the year; precipitation and the possibility of evaporation in the Lake region; fog; ice during the winter of 1898–99, and the wrecks and casualities which occurred during the year. A dozen charts illustrate the text.

R. DeC. Ward.

WAGNER FREE INSTITUTE OF SCIENCE.

The lectures for the spring term at the Wagner Free Institute of Science will commence on Monday, February 12, 1900. The following is the schedule:

Mondays, Dr. Henry Leffman, 'Chemistry.'

Tuesdays, Professor W. B. Scott, 'Dynamical Geology.'

Wednesdays, Professor R. E. Thompson, 'American History, 1783–1865.'

Thursdays, Professor G. F. Stradling, 'Heat.'

Fridays, Professor S. T. Wagner, 'Metallic Materials of Engineering Construction.'

Fridays, Professor T. H. Montgomery, 'Invertebrate Animals.'

Saturdays, Dr. Emily G. Hunt, 'Some Aspects of Botany.'

At the annual meeting at the Institute Mr. G. H. Cliff, formerly president of the Girls' Normal School, was elected a trustee to succeed the late Richard B. Westbrook, Esq.

From the report of the Actuary it was learned that 13,828 persons had attended the Fall course of lectures, that 28,378 persons had used the Reference Library and that the Branch of the Free Library had circulated 269,618 volumes for home use; 1327 books and 2226 pamphlets and magazines were added to the Wagner Institute Reference Library during the year. The report dwelt at some length upon the splendid collection of government documents owned by the Institute, probably the best in the City of Philadelphia, which was now classified and was being thoroughly catalogued. The thanks of the Board were extended to the officers of the Spring Garden Institute for an important addition to this collection.

The Board has given permission to the Philadelphia Natural History Society to hold its meeting in the Institute. This Society is in a most flourishing condition and there is an average attendance at the meetings of from 35 to 40 persons.

The number of accessions to the Museum during the year was 386, making a total of 14,880 exhibits, not including the insects of which there are about 5000 species. The collection of Florida Pliocene Fossils is one of the best and most complete in the country. Among the most important contributions are 100 species of fossils collected by Dr. H. G. Griffith on the Caloosahatchie River, Florida; 50 species of minerals presented by Mr. Joseph Wilcox, a number of zoological crustacea and mollusks collected by the Zoological Expedition to Florida in June, 27 local species from the Academy of Natural Science Exchange, 22 species of birds and nests from J. Harris Reed, and a collection of coal plants from the Rock Hill Coal and Iron Company. The local collection of insects is now the most complete in the City.

SCIENTIFIC NOTES AND NEWS.

MAJOR J. W. POWELL, director of the bureau of American ethnology, and Professor W. H. Holmes, head curator of anthropology in the United States National Museum, are in Cuba engaged in carrying out a plan for archæologic researches which are expected to throw light on pre-historic migrations of several native tribes, as well as on aboriginal commerce and interchange of arts. Their operations will extend to Puerto Rico and several other Antillean Islands.

THE REV. FATHER JOSÉ ALGUE, director of the Manila Observatory, and his associate, Father José Clos, have arrived at San Francisco on their way to Washington. They wish to arrange for the continuation of the work of the Observatory and the publication of the results by the government.

PROFESSOR A. J. HENRY, who has been for twenty years connected with the Weather Bureau and who is at present chief of the Division of Meteorology, has been appointed to fill the vacancy caused by the death of the late H. A. Hazen.

MR. A. A. HELLER has returned to Puerto Rico to extend his collections made in 1899 for the New York Botanical Garden. He will keep the field during January and February, with headquarters at Mayaguez in the western part of the island.

WE are glad to learn that Professor R. H. Chittenden of Yale University who has been seriously ill with typhoid fever is now better.

WE learn from *Nature* that the Council of the Manchester Literary and Philosophical Society have awarded the Wilde Medal for 1900 to Lord Rayleigh, for his contributions to mathematical and experimental physics and to chemistry; a Dalton Medal (struck in 1864) to Sir H. E. Roscoe, for his remarkable original researches in chemistry, and for his distinguished services to scientific education; and the Wilde Premium for 1900 to Professor A. W. Flux, for his papers on economic questions read before the Society. The presentation of the medals and the premium took place at a special meeting, when Lord Rayleigh delivered the Wilde Lecture for 1900.

M. POINCARÉ has been awarded the gold medal of the Royal Astronomical Society.

IT is understood that Sir John Lubbock, on his elevation to the peerage, has decided to take the name of Lord Avebury, after a property of his in Wiltshire. According to Sir John Lubbock's description in 'Prehistoric Times,' the temple of Avebury, Wiltshire, was the greatest of all so-called Druidical monuments.

M. M. DARBOUX and Moissan have been appointed delegates of Paris Academy of Sciences to the celebration of the second centenary of the Berlin Academy of Sciences.

AT the annual meeting of the Royal Meteorological Society, London, on January 17th, Mr. G. J. Symons, F.R.S., was elected president for the ensuing year.

AT the first meeting of the Académie de Médecine for 1900 the retiring president, Professor Panas, gave his valedictory address, reviewing the important work and communica-

tions of the past year. Professor Marey succeeds him in the presidency and Professor Guyon has been elected vice-president.

THE annual general meeting of the Neurological Society of London was arranged for February 8th, when it was expected that the president-elect, Dr. A. D. Waller, F.R.S., would deliver an address on the 'Excitability of Nervous Matter, with special reference to the Retina.'

WE regret to learn of the death of Mr. John Bernard Stallo, who died at Florence, on January 6th. He was born in Oldenburg in 1823, and came to the United States when he was sixteen years old. Mr. Stallo was a lawyer by profession, had been a judge at Cincinnati, Ohio, and had been minister of the United States at Rome, and had lived in Italy since 1885. He was the author of a volume in the International Scientific Series entitled, 'The Concepts and Theories of Modern Physics,' which is in many ways a remarkable and important work. He was also the author of 'General Principles of the Philosophy of Nature,' and 'Redung. Abhandlungen und Briefe.'

A TELEGRAM has been received at Harvard College Observatory from Professor Kreutz, at Kiel Observatory, stating that a comet was discovered by Giacobini at Nice, January 31^d .292 Greenwich Mean Time in R. A. $2^h\ 57^m\ 44$ and Dec. $-7°\ 55'$.

A COMMITTEE of the Pan-American Medical Congress has asked the U. S. Department of Agriculture to coöperate with other nations in an investigation of the medicinal flora of the United States, and Secretary Wilson has asked for an appropriation of $10,000 for this purpose.

ON the 21st of February the Senate committee on the District of Columbia will hold a hearing on the subject of the anti-vivisection bill now pending before the Senate. This hearing will be attended by leading advocates of vivisection from all parts of the country, as well as by those who favor the pending bill. Dr. W. W. Keen, president of the American Medical Association, has published in the *Philadelphia Medical Journal* an appeal to the medical profession of the United States in regard to the bill. Dr. Keen in his appeal states that the "Bill is speciously drawn to seem as if it were intended only in the interest of prevention of cruelty to animals," that the "real object of the Bill is twofold: first, to prohibit vivisection, and secondly, to aid the passage of similar Bills in all the State Legislatures." He says "that this would seriously interfere with, or even absolutely stop, the experimental work of the Bureau of Animal Industry, and the three medical departments of the Government—the Army, the Navy and the Marine Hospital Service." He therefore appeals "to the entire profession of the country to exert themselves to the utmost to defeat this most cruel and inhuman effort to promote human and animal misery and death, and to restrict scientific research."

THE Senate Committee on Commerce, on February 1st, practically decided on a favorable report upon the bill creating a department of commerce, but owing to the desire to change some of the details of the measure, it will not be reported for some time.

AT a recent meeting of the Board of Trustees of the University of Wyoming, the herbarium connected with this institution was officially recognized as The Rocky Mountain Herbarium, and Dr. Aven Nelson, professor of botany in the University, was named curator. The object of the herbarium is to make an accessible and serviceable collection of the plants of the Rocky Mountains. The collection will be a general one but plants of economic importance will have special attention. It is especially desired to represent fully forage of all kinds, useful and ornamental trees and shrubs, and herbaceous plants which are of interest to the gardener or are desirable for the decoration of the home grounds. Besides these the parasitic fungi and the fleshy fungi are to be fully represented. The present collection numbers nearly 18,000 sheets. The coöperation of botanists and collectors is requested. Sets of plants collected in the Trans-Mississippi portion of the United States are especially desired as well as co-types or representative specimens of new species from this region. Correspondence concerning specimens and exchanges should be directed to the curator.

PLANS are being made for the enlargement

of the John Crerar Library, Chicago, which it will be remembered is devoted to scientific works. The Library at present occupies the sixth floor of the Marshall Field building, and a part of the fifth floor is now to be added. A room will be provided for society meetings. The number of accessions to the library during the past year is 12,360, and the total number of books and pamphlets in the library is now 80,000.

MME. MEDVEDNIKOVA, who died recently near Moscow, has left $3,000,000 to charities, chiefly to hospitals and asylums.

THE department of superintendence of the National Educational Association will meet in Chicago on February 27th and 28th, and March 1st. Professor Nicholas Murray Butler will make an address at the first sesson on the 'Status of Education at the Close of the Century.' Other addresses will be made by President Benjamin Ide Wheeler of the University of California, Mr. Walter H. Page, and others. Professor W. O. Atwater, of Wesleyan University, will present a paper on alcoholic physiology and superintendence.

AT a meeting of the Royal Geographical Society held on January 23d, in the theatre of the University of London, Mr. H. J. Mackinder, reader in geography at the University of Oxford, read a paper describing his recent journey to the summit of Mount Kenya, British East Africa. The results of the expedition were a plane-table sketch of the upper part of Kenya, together with rock specimens, two route surveys along lines not previously traversed, a series of meteorological and hypsometrical observations, photographs by the ordinary and by the Ives color processes, collections of mammals, birds and plants, and a small collection of insects.

THE new German Society for Volkshygiene held its first public meeting during January in Berlin. Dr. Boediker took the chair, and there were delegates present from the German Ministry of the Interior, from the municipalities of Berlin and Charlottenburg, and from the government of the Province. Professor Fuchs, rector of the University, and Professor Riedler, rector of the technical high school, were also present, and many medical men of distinction, among them Professors v. Leyden, Jolly, Ewald, Rubner, and Lassar. In his introductory address, the president described the objects of the new Society.

THE New York *Medical Record* gives the following summary of the invasion of the Islands of the Pacific by the plague: In Honolulu, up to January 17th, there had been thirty-nine deaths, one of a white woman and the others among natives and Asiatics. The board of health has burned ten blocks of houses in the plague-infected section. A Red Cross society, formed by some of the ladies of Honolulu, has done most effective work, and the local physicians and clergymen have continually gone among the sick and dying, submitting to voluntary isolation in order to minister to the needs of the sick. In Noumea, New Caledonia, the disease has prevailed since early in December. There were sixteen deaths during the first ten days following the development of the malady. Up to December 23d there had been no deaths among the whites, eight of whom had been infected, but nine Kanakas, two Japanese, and five Tonkinese had died of the disease. The part of the town where the infection first developed has been surrounded with a high galvanized iron fence seven hundred yards long. The principal business houses, official buildings, and the banking and shipping offices are guarded by posses of soldiers. Twenty buildings in the infected quarter of the town were demolished by the health authorities, but, despite all the precautions, the plague has continued to spread, the number of new cases averaging three daily. At Sydney, New South Wales, general alarm is felt in consequence of the arrival of eleven passengers from Noumea, who landed before news of the plague's presence was received. Extraordinary precautions have been taken throughout Australia and strict quarantine is established. In the case of a wharf laborer in Sydney, who was attacked on January 24th, the inoculation was apparently traced to a flea bite. In Argentine Republic the plague is officially announced to exist at Buenos Ayres and Rosario, both of which ports have in consequence been closed.

THE *British Medical Journal* states that the King of Italy has promised to open a hygienic exhibition at Naples in April, and it will remain open until September. The construction of the buildings is being pushed on with great zeal, and funds are assured partly by direct donations and partly by redeemable shares. Several conferences will be held. The most important will be those on the prevention of tuberculosis, and on the promotion of physical education. Amongst the most interesting 'side shows,' will be an exhibition of works of 'Sacred Art.' The Minister of Public Instruction has directed that objects of this description at present located in public museums and buildings shall be lent. There will also be a 'Pompeian Pavilion,' in which will be reproduced the public and private baths of Pompeii and other objects of interest.

THE Medical Society of the State of New York held its 94th annual meeting, at Albany, on January 30th and 31st, and February 1st. We learn from the report in the New York *Medical Record*, that the inaugural address of the president, Dr. W. G. Macdonald, reviewed especially the work of the Society. He said that the efforts of the Society's committee and of the New York Bar Association to improve the status of medical expert testimony had unfortunately resulted in nothing more than a better general understanding of the intricate problems involved. In the opinion of the speaker the legal profession is responsible for the present order of things. Presiding judges could readily remedy existing abuses by excluding medical advocates from the witness box. A voluntary society of men doing expert work could do much to regulate the condition. On the topic of State control of such chronic diseases as tuberculosis and syphilis, the speaker stated that the tendency at present was toward such State control and isolation in sanatoria. The Committee on Legislation reported that two hundred and sixty-five bills of a medical nature had claimed the attention of the committee during the four months' session of the last legislature. The committee on the United States Pharmacopœia, favored the establishment of a bureau of materia medica for the disinterested investigation into the character and value of new drugs, the bureau to be under the authority of the dicennial convention of 1900, subject to the provision that this bureau should report annually. The Society recommended the continuation of the State appropriation for the support of the Pathological Institute, but there was some criticism of its methods.

UNIVERSITY AND EDUCATIONAL NEWS.

THE Regents of the University of California have adopted the policy of giving the professors of the University one year's leave of absence in seven. They are usually to receive two-thirds of the regular salary, but those who have not yet received a leave of absence may receive full salary.

IT is now said that the decision of the Court of Appeals of New York sustaining the will of William Lampson, ends the litigation over his will, so far as any question of law is concerned. The heirs, however, will contest the will on the ground of the incompetency of the testator. The value of the propeerty which is largely real estate is estimated at $350,000 or more.

PRESIDENT LOW of Columbia has been asked to deliver the address at the celebration at Dartmouth College next year of the centennial anniversary of the graduation of Daniel Webster from that institution.

DR. G. A. MILLER of Cornell University was recently elected to membership in the Mathematical Society of France.

M. GABRIEL TARDE, well known for his contributions to psychology and sociology, has been elected to the chair of modern philosophy in the Collège de France.

PROFESSORS Ebner and Schaffner, who have hitherto acted as assistants in the Embryological Institute of the University of Vienna, have been appointed acting directors on the retirement of Professor Schenk.

DR. A. KLAUS, professor of chemistry in the University of Frieburg in Br., has retired on account of ill health.